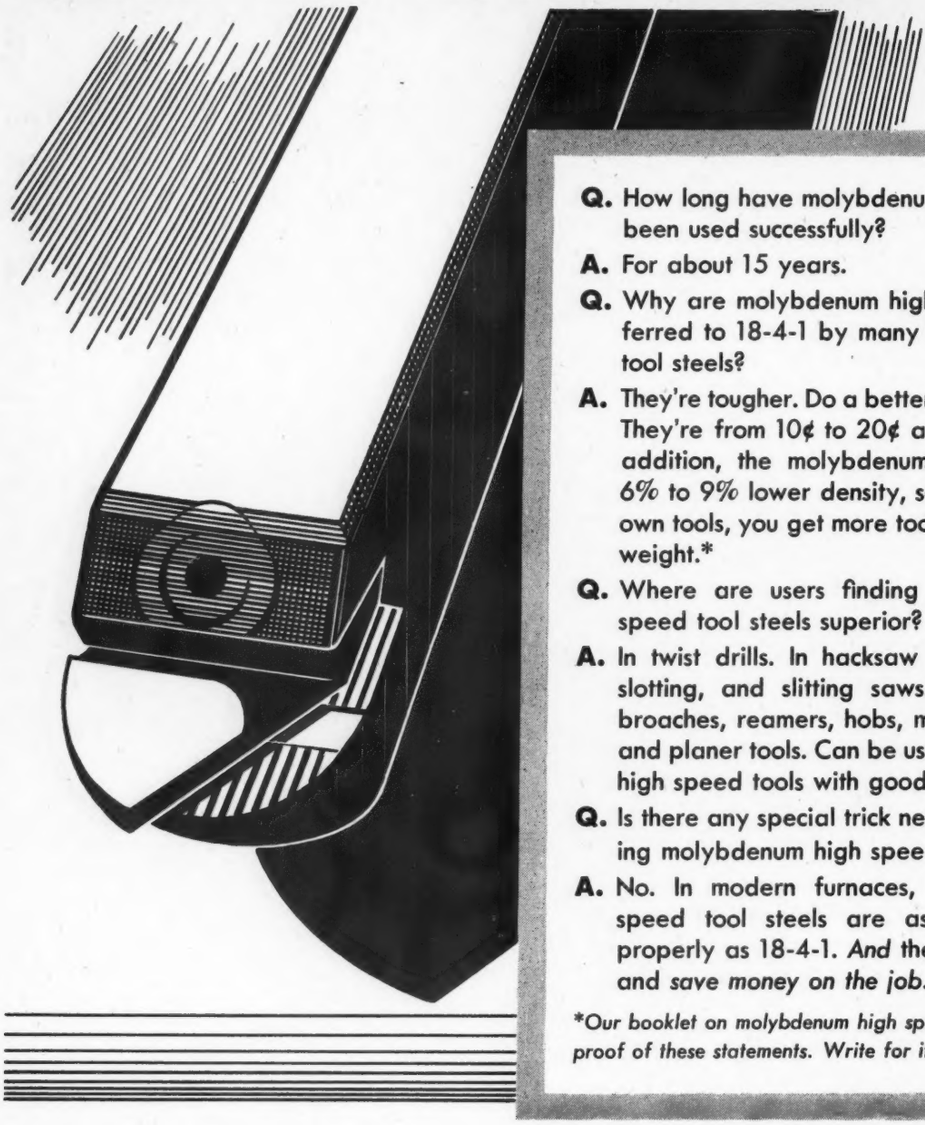
, 1948

e tech engineering news

QUIZ ON HIGH SPEED STEELS



Q. How long have molybdenum high speed steels been used successfully?

A. For about 15 years.

Q. Why are molybdenum high speed steels preferred to 18-4-1 by many large consumers of tool steels?

A. They're tougher. Do a better job for less money. They're from 10¢ to 20¢ a pound cheaper. In addition, the molybdenum steels have from 6% to 9% lower density, so if you make your own tools, you get more tools for a given gross weight.*

Q. Where are users finding molybdenum high speed tool steels superior?

A. In twist drills. In hacksaw blades. In milling, slotting, and slitting saws. In taps, chasers, broaches, reamers, hobs, milling cutters, lathe and planer tools. Can be used for all classes of high speed tools with good results.

Q. Is there any special trick needed in heat treating molybdenum high speed tool steels?

A. No. In modern furnaces, molybdenum high speed tool steels are as easy to harden properly as 18-4-1. *And* they cost much less—and *save money on the job.*

**Our booklet on molybdenum high speed steels will give you proof of these statements. Write for it.*

MOLYBDIC OXIDE—BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"
CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

Climax Molybdenum Company
500 Fifth Avenue · New York City

MOLY

BUDD DISC BRAKE

(MODEL CF)

THE GREATEST IMPROVEMENT IN RAILWAY BRAKES SINCE THE INVENTION OF THE AIR BRAKE....

Ten years of research, and millions of miles of actual railroad operation under extreme conditions, have gone into perfecting this brake.

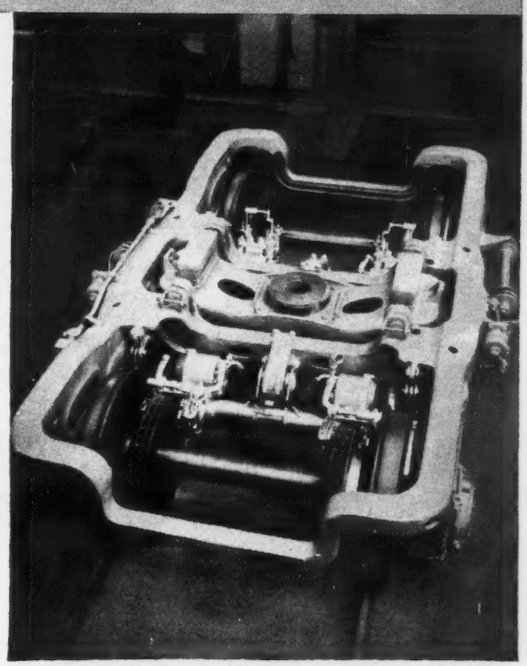
It can stop a car weighing 160,000 pounds from 60 miles an hour in less than 1000 feet; from 80 miles an hour under 1600 feet; from 100 miles an hour in less than 2500 feet.

This is not a trick performance. The capacity of the brake permits the successive repetition of this braking required in actual day-to-day operation. And it is also great enough to swallow the overload when operating in train consists with cars and locomotives of less braking capacity.

Stopping is so smooth and chatter-free—even under emergency application—that the passenger is barely aware that the brakes are applied.

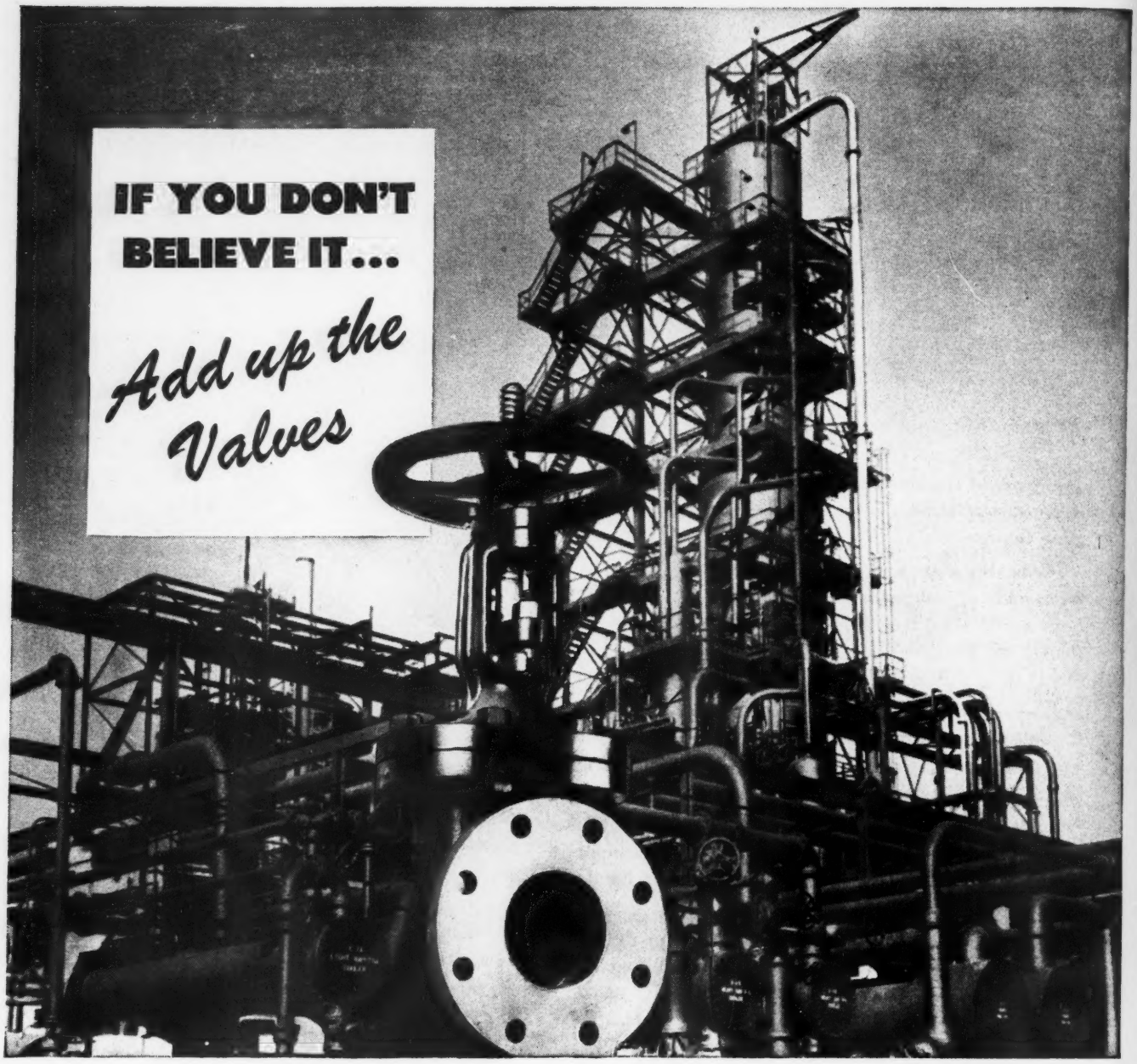
The Budd Disc Brake cuts maintenance cost. Wheel life is increased 70% or more. Average brake shoe life is 100,000 miles. Disc life is a minimum of 5 years. There are no slack adjusters, no speed governor, no cumbersome and heavy brake rigging. Bearings on all moving parts are specially hardened and oversized far beyond strength requirements to reduce wear. All pins are held under spring compression to prevent clatter and lengthen their life. Weight savings amount to as much as 1000 pounds per car.

The brake meets all AAR requirements and is available for installation on new equipment and for replacement of clasp brakes now in service. Complete information will be furnished at your request. The Budd Company, Philadelphia.



The brake never comes in contact with the wheel. Instead, it engages a separate disc, mounted on the wheel. The multiple vents in the disc have the effect of a fan, dissipating heat. Even on the long, heavy grades in the Rockies there is no overheating.

Budd



No . . . there never was a valve this big. But if *all valves* in this refinery were *one valve*, this picture would be no great exaggeration.

Today, with wages and material costs the highest ever, it pays management to think about valves collectively, and keep the same sharp eye on valve maintenance costs that they do on large unit maintenance.

EXCESSIVE MAINTENANCE of one valve is insignificant, but multiplied by thousands, it is a serious drain on operating budgets.

JENKINS BROS. helps management meet this problem. First, by building extra endurance into Jenkins Valves, making them the longest-lasting, lowest-upkeep valves that money can buy. Second, with advice from Jenkins Engineers on any question of proper selection, installation, or maintenance.

That's why, for new installations or replacements, alert management relies on Jenkins quality and engineering for lowest valve costs in the long run. *Sold through leading Industrial Distributors.*

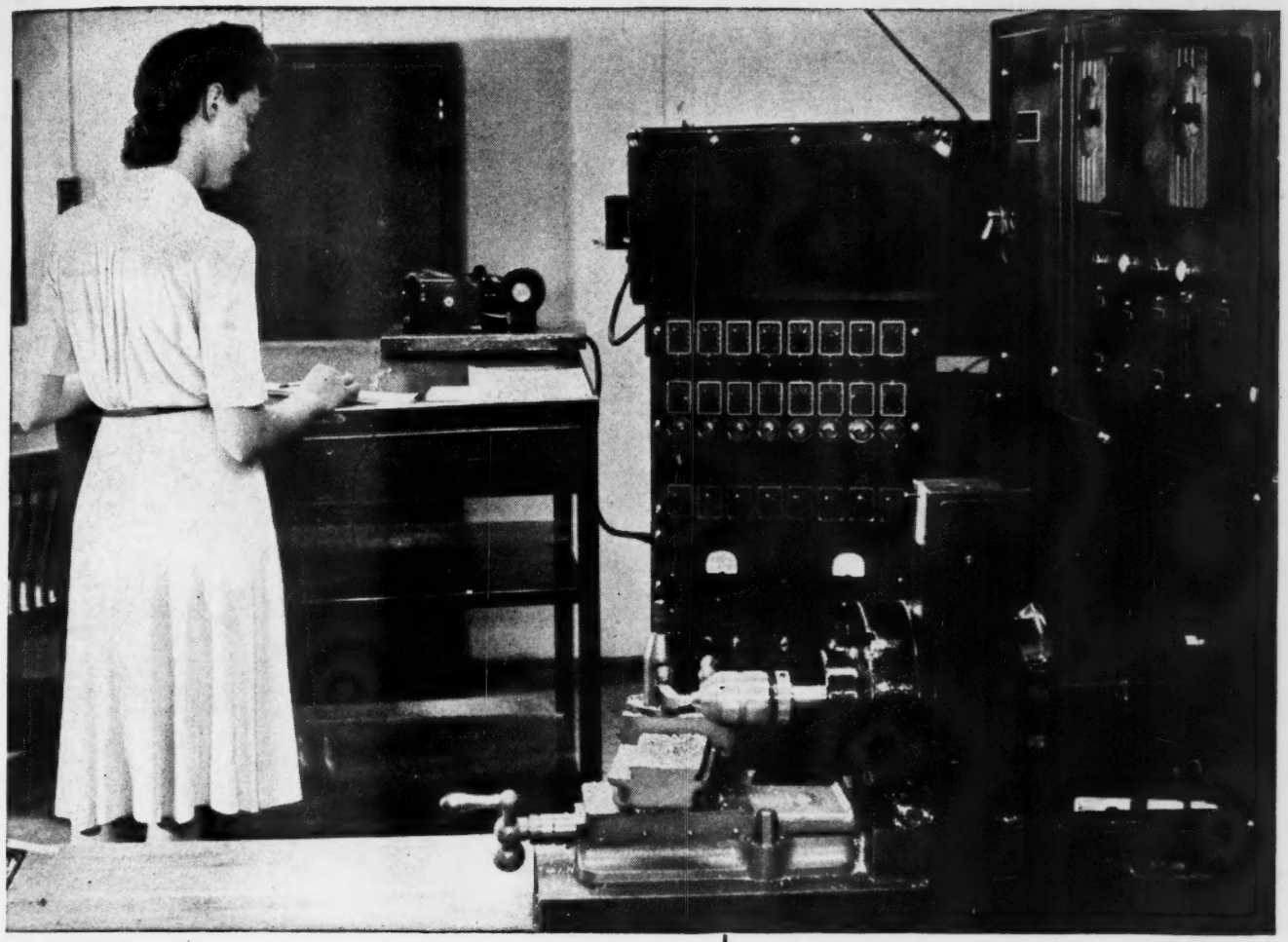
Jenkins Bros., 80 White St., New York 13; Bridgeport, Conn.; Atlanta; Boston; Philadelphia; Chicago; San Francisco. Jenkins Bros., Ltd., Montreal.

"PRACTICAL PIPING LAYOUTS" is a 32-page book containing diagrams and descriptions of 25 basic piping layouts with complete recommendations for valve selection and location in the lines. Tells you "which valve where for best performance". FREE on request. Write JENKINS BROS., 80 White Street, New York 13, N. Y.

LOOK FOR THIS JENKINS DIAMOND MARK
SINCE Jenkins Bros. 1864

JENKINS VALVES

Types, Sizes, Pressures, Metals for Every Need



Typical of its laboratory activities, Dow recently developed this direct-reading spectrometer that electronically measures concentration of elements in alloys—automatically records analyses in 40 seconds.

Horizons of Chemistry constantly beckon . . .

Dow is deeply interested in colleges and technical schools and maintains close ties with them. The very nature of our business makes this a logical course for us to pursue.

We are producers of chemicals essential to industry and agriculture. We are developers of plastic materials. We are the pioneer producers of magnesium, recovering this lightest of all structural metals from ocean water. We are developers of magnesium alloys and methods for their fabrication.

To carry on this work, research is a necessity and a considerable portion of our efforts and resources are devoted to it as an undeviating policy.

All these activities require trained men—scientists and technicians—chemists and chemical engineers—metallurgists, biologists, physicists, entomologists. Dow employs such men in large numbers—keeps an eye on them as they emerge from their academic training—gives many of them special schooling at the Dow plants, according to the jobs they are slated to do.

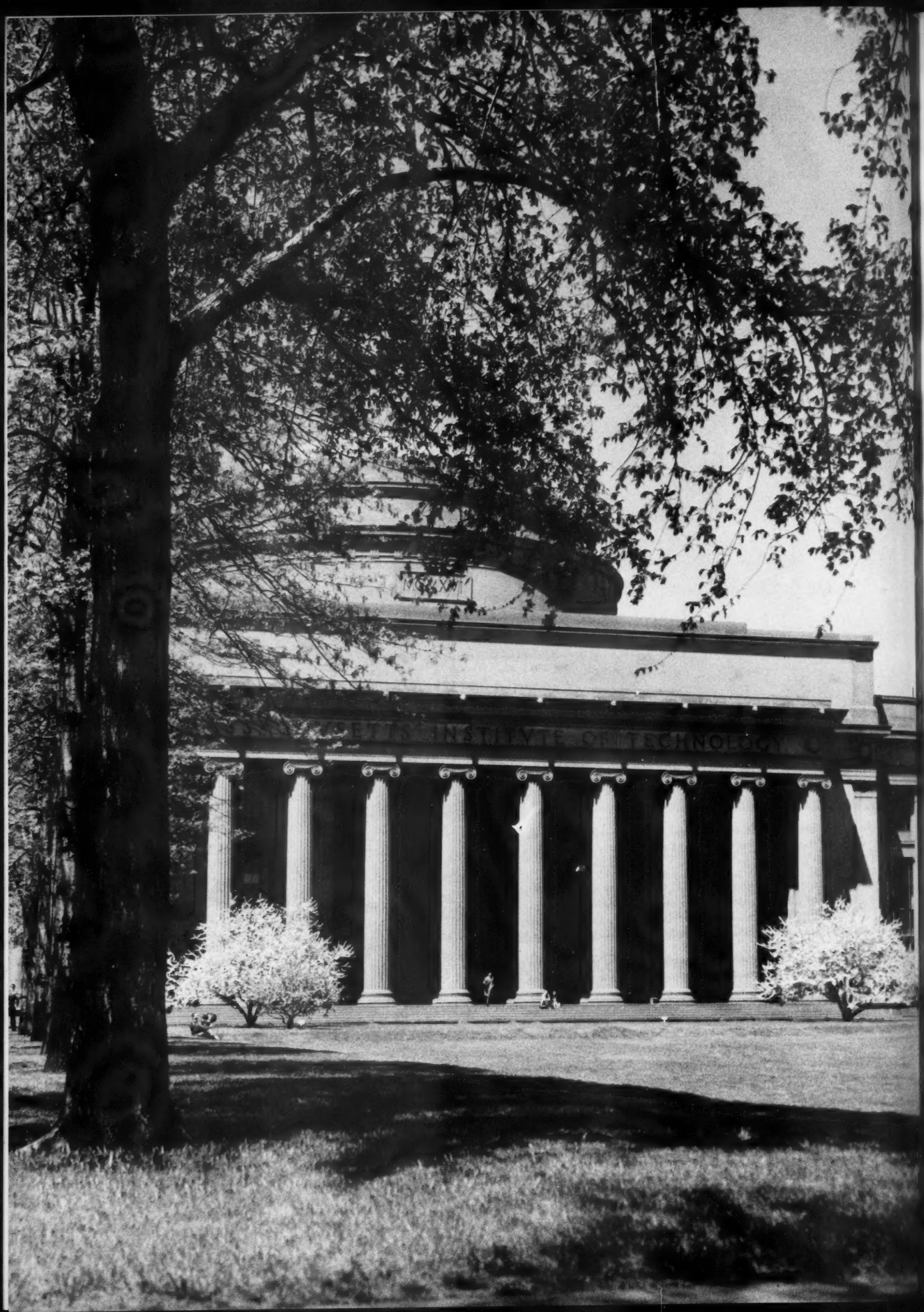
In peace as well as in war, chemistry is an essential occupation because it deals with materials essential to industry and to the health of the nation. It is a developing business with horizons that constantly beckon—a profession to intrigue any ambitious young man with an eye to the future.

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit
Chicago • St. Louis • Houston • San Francisco • Los Angeles • Seattle
Dow Chemical of Canada, Limited, Toronto, Canada

DOW

CHEMICALS INDISPENSABLE
TO INDUSTRY AND AGRICULTURE



the tech engineering news

April 1948
Vol. XXIX No. 6

Cars for Tomorrow 235
Charles M. Jordan, '49

Enzymes and Poison Ivy 239
Fred H. Bergmann, '50

Synthetics from Oil 241
Marc L. Alfandry, '51

John Hancock Progresses 243
Roy W. Jenkins, '50

The Story of an Unobservable 246
H. H. Lanier, '48

Automotive Chassis Design 247
Helmut Weber, '50

From the Editor's Notebook 234

Masthead 250

Dragon's Den 251

Cover Design by Charles M. Jordan, '49

MEMBER OF THE ENGINEERING COLLEGE MAGAZINES ASSOCIATED

Published monthly during the school year at Walker Memorial, Cambridge 39, Massachusetts, by the undergraduates of the Massachusetts Institute of Technology. Entered as second class matter, at the Post Office, June 1, 1920, at Boston, Massachusetts under the Act of March 3, 1879. Copyright 1948 by The Tech Engineering News. Subscription per year $1.50. Foreign $2.25. One copy 25 cents.

from the editor's notebook

For some time now the *T. E. N.* staff has been considering its make-up with a critical eye. With the general modernizing and the effort to vitalize the magazine that was taking place, the layout of the magazine between the covers was conspicuously out of date. Our covers pleased us but what followed did not. Yet, realizing that a successful modern arrangement of material in the magazine could not be initiated without the help of some one with special artistic skill, we were hesitant to make any changes.

A while back, **Charlie Jordan** started drawing our covers for us, and since then the question of what would be a good layout for the *T. E. N.* has been in the front of our minds. After much discussion and a considerable amount of work, sparked and guided by Charlie, the layout for this issue evolved. We certainly hope it will meet with the approval of our readers, and in any case will be very interested in hearing any comments they may have about it.

Charlie has not limited himself to merely the art involved with publishing the *T. E. N.* This month he joins the ranks of *T. E. N.* authors with his article on automobile design. Charlie is no small authority on this subject. He already has to his credit a $4,000 first prize in the Fisher Body Design Contest for his well-thought-out design and painstakingly built model of the car of the future. Nor has Charlie limited himself to being active in the *T. E. N.*, here at Tech he is Chairman of the Society of Automotive Engineers, President of the Combined Professional Societies, and Vice-President of the Inter-Varsity Christian Fellowship. A Southern Californian from Whittier, Charlie's interest in sports centers around baseball.

Ex-chief Radio Technician **Harold Lanier** wandered into the office a few weeks ago to offer us — voluntarily, almost! — his term paper for his senior humanities subject, History of Ideas. It seems that Professor Deutsch, may his tribe increase, had rightly suggested we might like his article, which indeed we did — after a period of slight bemusement while we were deciphering it. Lanier, a veteran of four years in the Navy (including one and a half years at Tech under V12) really deserves a lot of credit for a piece of original work. He graduates this June in Tech's General Science Course and then plans to work in communications.

Roy Jenkins, '50, our make-up man, whose seven years of construction experience as carpenter, pile driver, and rigger include two months of pile driving on the foundation of the Hancock building, is indeed well-fitted to write this sequel to his last year's story on the John Hancock. A building construction major from Belmont, Roy finds time to play on the varsity soccer team, be a Soph and Junior Prom Committeeman, and handle several part-time jobs to boot.

Fred Bergmann, '50, a farm lad from Saugerties, N. Y., whose main interest in life seems to be biochemistry, has given us the lowdown on that old favorite, poison ivy (and poison oak too for the benefit of any Westerners). Now a United States citizen, Fred was born in Germany and didn't leave there until 1939; once here, he kept himself busy attending Kingston High and working in medical labs on the side.

Wauwatosa, Wisconsin claims **Helmut Weber** as one of her promising progeny. Helmut was with the Army Ordnance during the war, but back in the fall of 1946 he entered M. I. T. as a student of mechanical engineering. However, he plans to switch to the General Science and Engineering Course so that he may take a little nuclear physics along with his mechanical engineering subjects. In the way of activities, besides being active on the *T. E. N.* business staff, Helmut also finds time to play the tuba and make arrangements for getting married this June.

Marc Alfandry, a repeat performer from the February issue, has used his Chemical Engineering background in giving us a picture of further uses of petroleum as a raw material for many new hydrocarbons. Originally from Egypt, Marc served with the United States Army from 1946 to 1947.

cars for tomorrow

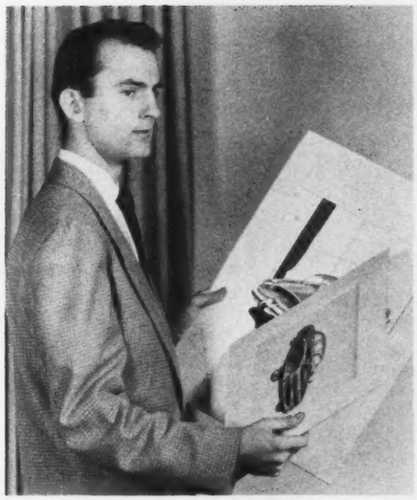
Charles M. Jordan, '49

A Study of Post-War Styling Trends and a Prediction for the Car of the Future

The 1948 Cadillac is a far cry from the family buggy of a century ago. For years in the development of the automobile from its crude, one cylinder, bicycle-wheeled ancestor, the automobile has carried the earmarks of the family buggy it supplanted. In reality, the automobile was a new form of mechanical transportation. It served *the individual*, taking him where and when he wanted to go. To do this well, the automobile had to fulfill a number of very definite requirements.

In the first place, the owner wanted to move about at a rapid rate. He wanted to do so comfortably. He required a vehicle that could be operated with ease and confidence. Because the motor car was a personal possession, often second only to the home in which he lived, it was essential that it express individuality, style, and good taste. This expression in automobile design is styling. More specifically, styling is the combination of mechanical requirements with human requirements to bring together the science of the engineer and the skill of the artist in order that the automobile might be as beautiful as it is useful.

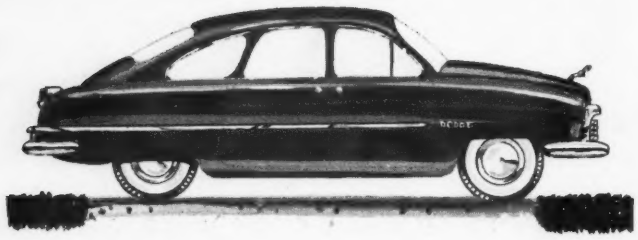
The automobile is fashioned with physical materials — with steel, glass, wood, fibre, and cloth. It has texture and color. It is built in conformity with the laws of gravity and elasticity. Weight, mass, thrust, and height are all involved in its construction. It remains the job of the stylist to capture the right proportions of each of these to yield a car which is functional as well as beautiful.

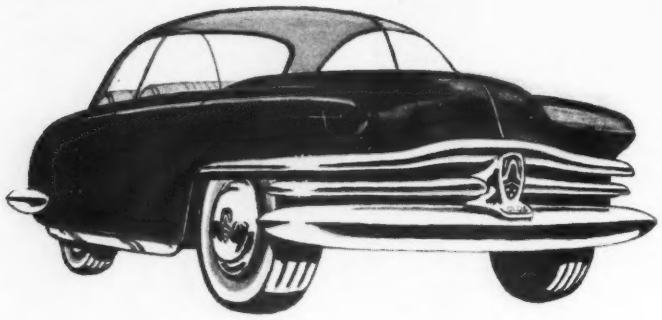


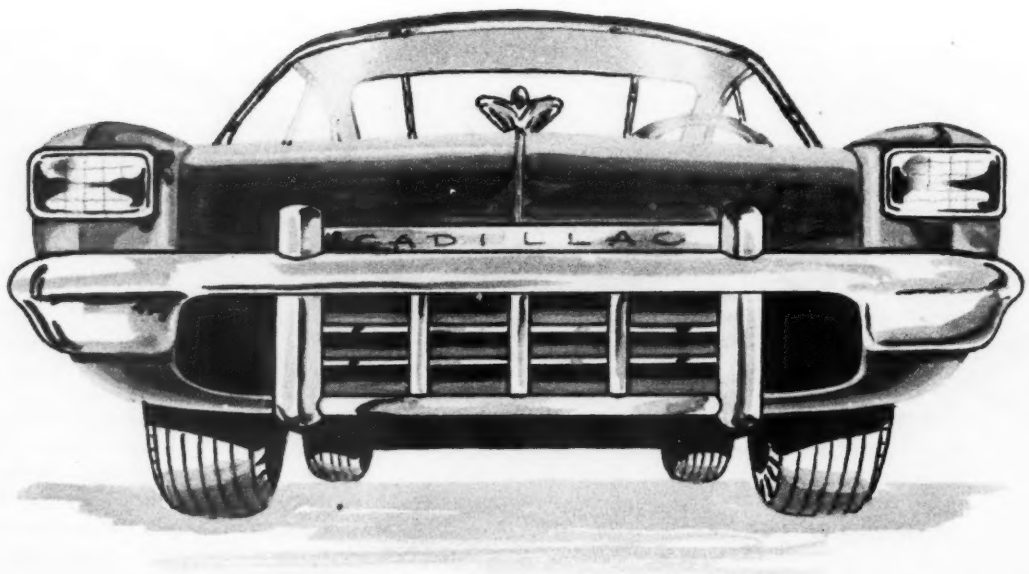
Charles M. Jordan

While the mechanical advances of the automobile during recent years have been remarkable, the styling has been equally astonishing and aggressive. It has kept pace with mechanical improvements; it has, in some instances, even outpaced them — not always with

A Futuristic Ford design *Jordan*







Designs by Jordan, showing varying degrees of development in future automotive styling trends.

happy results. Nevertheless, styling in the main has been governed by scientific, not freakish, applications, and the findings of research have been utilized to their full extent within the limitations imposed by production methods and costs.

The increased importance of styling in the modern motor car cannot be overemphasized. In the "new look" era, ushered in by Studebaker and Kaiser-Frazer and recently supported by Hudson, Packard, Oldsmobile, and Cadillac, there is one generality which can safely be made in almost each case. That is that styling changes have been far more prominent than mechanical changes. Good styling, beauty in shape and color, have definitely become determining factors in automobile sales. This is not bad. The "new look" styling trend is becoming more and more integrated with increased comfort, safety, practicability of maintenance, and performance.

Stylists frequently must wait on technological advancement. Progress in design is evolutionary, not revolutionary. Advancement comes in logical sequence. Always there is a race between an ideal of what a thing should be and our ability to make it that way. The stylist must wait for new materials, and new methods and machinery to work these materials, and upon mechanical improvements in the car itself before the car can be made as the stylist pictures it in his mind. Remember: evolution — not revolution.

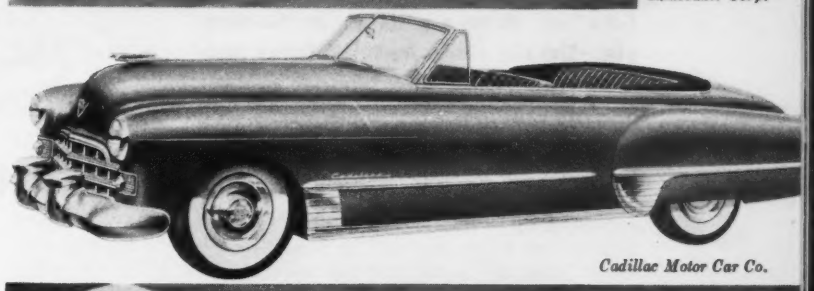
As automobile styling shifts from pre-war to the "new look" of the post-war pattern, the influence exerted upon it by automotive science becomes more pronounced than ever. The transition period indicates that chassis limitations upon the stylist are fewer than they have been in the past. Chassis specifications have become more flexible. Limitations imposed by production and manufacturing methods have also decreased, for vastly improved production techniques were developed through intensive war research and experimentation. Offsetting these, however, are the much greater economic handicaps under which the stylist works. Cost of materials, supplies, and labor have risen greatly over pre-war levels. They, of necessity, restrict the designer in his creation of his new patterns.

While automobile styling prior to the 1920's was in many ways a hit-and-miss proposition, since that time it has exhibited some definite characteristics. General styles are constantly changing. This is not less true in the automotive industry. It will be our purpose here, then, to examine the new trends affecting automobile styling today and, by use of these trends, predict what to expect in tomorrow's car.

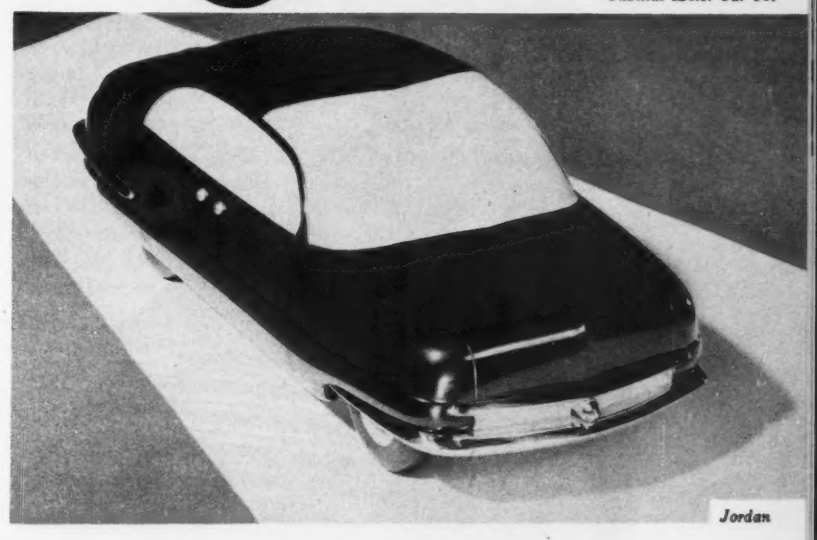
The styling of automobiles until recent years was done to a large extent upon the basis of lines. These designs could readily be sketched on a blackboard and the block or box outlines of the finished automobile were quite easily comprehended. Today, lines are being greatly replaced by highlights and surfaces with increasing amounts of form and roundness. This can be clearly illustrated by comparing the 1947 and 1948 Hudson body design. The 1947 design was a confusion of shapes put together and plastered with a maze of chrome strips to accentuate the "lines" of the car. The 1948 Hudson design takes advantage of the beauty of simple forms and shapes molded together into a graceful unit design.

An increasingly important trend in automotive styling is simplicity and massiveness. This trend features clean bold surfaces. The evolution of the Oldsmobile grill illustrates this trend well. From a chrome-plated juke box appearance in pre-war days, the grill

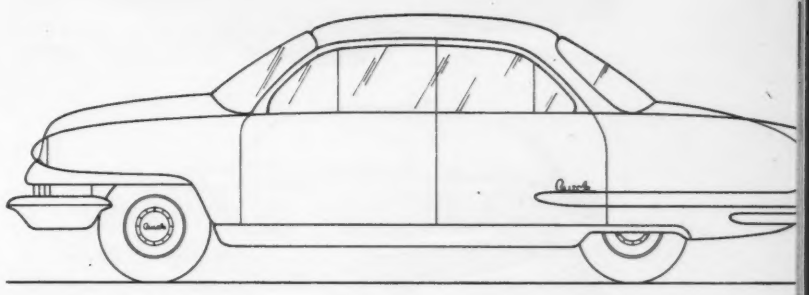
Studebaker Corp.



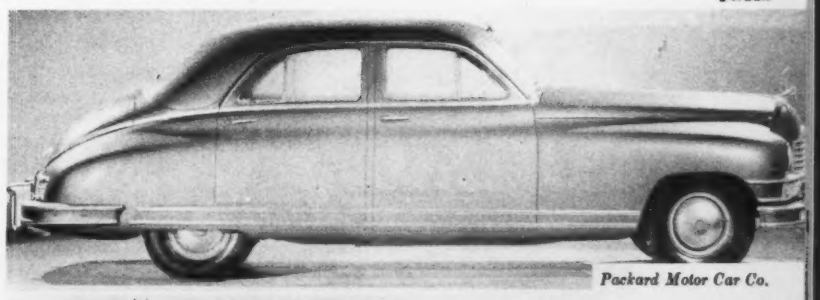
Cadillac Motor Car Co.



Jordan



Jordan

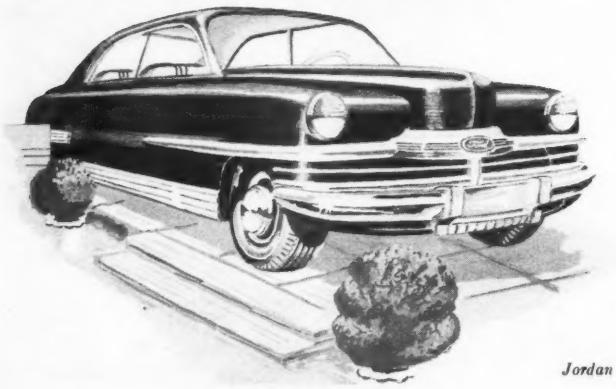


Packard Motor Car Co.

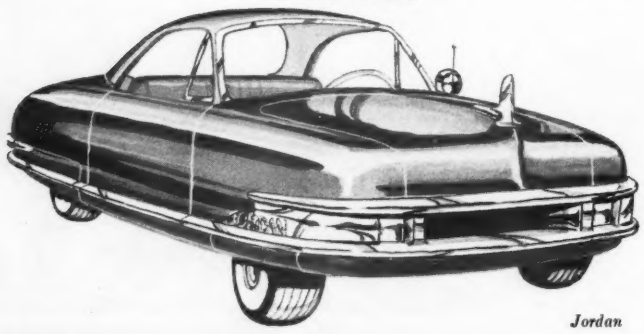
Juke box chrome grills are on the way out. Simple, clean body surfaces and increased vision and bumper protection are predicted. Styling in trucks will become increasingly important.

Jordan

Jordan



Jordan



Jordan

has evolved into two simple, massive, horizontal, curved bars integrated with a clean bold bumper by two massive, gracefully-curved bumper guards featured on the new 1948 Futuramic Oldsmobile.

In post-war "new look" body design, there have developed two distinct trends. One we may call the "crisp" school of design illustrated by the Studebaker, Oldsmobile, and Cadillac. The other we may call the "Jello" school supported by Kaiser-Frazer, Packard, Hudson, and the widely-discussed Tucker. In the "crisp" type of design, a subtle handling of long, flat, sweeping surfaces with a quick hook or curvature at the leading and trailing edge provide an illusion of length where the truly long dimension does not exist. In general, this school of design still retains the rear fender. This "crisp" style of design produces a body which appears light, fleeting, long but small. The "Jello" school of design takes advantage of the fact that the public has been well educated in curves with reference to aerodynamics and streamlining. The "Jello" style of design makes use of these forms with many other slow curving surfaces and few sharp lines of demarkation. This type of design uses the "generous fillet" condition tending to mold each separate form into one graceful streamlined form. The "Jello" design is characterized by a fat, heavy, massive, powerful appearance.

A surprising trend in post-war styling is in the design of trucks. All four popular makes of trucks — Ford, Dodge, GMC, and Chevrolet — set some very new patterns, and show increased emphasis on truck styling, something which prior to the war was clearly a secondary factor in truck design. The Chevrolet truck is an outstanding example of good truck styling.

By the end of 1948, all companies will have announced their real post-war models. Each will definitely have the "new look" but all will be similar to those already on the road.

Now let us look into the fascinating trends in automobile styling for the future.

Of more than passing interest has been the influence exerted by "Buck Rogers" automobile stylists during the war. The Sunday newspaper supplements were packed with illustrations, photos, charts, diagrams and whatnot, setting forth the course of the automobile stylist in the post-war years. The public, quite naturally, demonstrated a sharp interest in these designs, for it had come to expect miracles as a result of the sensational discoveries and scientific applications made by a great nation at war. But styling a motor car on

(*Continued on page 262*)

enzymes and poison ivy

Fred H. Bergmann, '50

An enzyme is a definite chemical substance of organic nature, heat sensitive, and capable of increasing the velocity of a chemical reaction without being used up in the process, or becoming a part of the products formed. In other words, an enzyme is a biocatalyst. It has now been discovered that these versatile biocatalysts may be a new approach to the problem of taking the itch out of poison ivy.

Poison ivy is found mainly east of the Mississippi and grows in the form of woody vines and bushes. Oddly enough, the plant belongs to the cashew family, all the members of which produce skin irritants. Other unpopular members of this family include poison oak, poison sumac, and the cashew nut tree, the sap of which also causes skin irritations.

Numerous quack remedies for poison ivy have been advocated and probably every poison ivy sufferer has, at one time or another, received advice by some well-meaning soul. The author has heard discussions of the merits of eating the leaves of the plant to acquire an immunity, and has been told by another of the well-meaning souls that strong vinegar applied liberally on the skin is a wonderful antidote for the "poison."

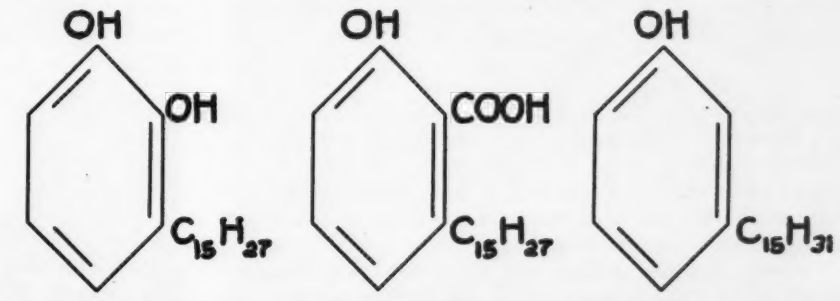
Actually the "poison" or active principles of poison ivy have been known since about 1922 to be closely related fat-soluble phenols characterized by a long unsaturated side chain attached to the ring. These compounds can be most easily isolated by the use of fat solvents such as absolute alcohol, ether, and oils. Hot one hundred per cent alcohol is very effective, since the toxic compound may be concentrated by distilling off the alcohol. The structure of many of these compounds has been determined, and similar compounds such as tetrahydrol-annacardol have been synthesized. From some other members of the cashew family similar compounds have also been isolated. It is believed that their irritant action is due largely to the presence of hydroxyl groups in the ring, for when these are oxidized, the toxicity of the compound largely disappears.

Because we now know the structure of the poison ivy irritant, there are many good measures that can be employed to prevent the spreading of the infected area. When it was realized that the irritant was a fat-soluble substance, the use of a detergent, such as strong yellow soap, to remove the oil from the skin became obvious. Fat solvents, such as one hundred per cent alcohol, ether, or acetone, have also been found helpful. For similar physical reasons the use of creams or greasy ointments becomes worse than useless, since the oily active principle is only spread by their application. Since it was found that the oils are easily oxidized, treatment of the dermatitis by inorganic oxidizing agents is possible. The oxidizing agents most commonly used are a five per cent solution of either ferric chloride or potassium permanganate.

In extreme cases of poison ivy, the toxin has penetrated into the lymphatic system and is spread throughout the body. Little can be done for these cases except the application of solutions of Epsom salts or baking soda in order to alleviate the itching. Medical men believe that the injection of poison ivy antigen (extract of poison ivy) to the patient is of great help in these cases, but this has not been definitely proven.

It has already been pointed out that the hydroxyl groups in the toxic oils of poison ivy are easily oxidized. As early as 1923, J. B. McNeir pointed out that enzyme action might bring about the oxidation of these phenols to ketones. In 1945 Irwin W. Sizer and Clemens E. Prokesch of the Department of Biology of the Massachusetts Institute of Technology suggested that the oxidative enzyme tyrosinase can inactivate poison ivy and have since then done some work on the problem.

Chemical tests to show that the irritants could be oxidized by tyrosinase were the first step. The Barcroft Differential Respirometer, a machine that can measure the oxygen consumption of a solution, was employed in these tests. Experiments were performed both with crude poison ivy and poison oak extracts, and with highly purified compounds. All experiments showed that there was a fairly rapid oxidation of the toxic compounds by the enzyme tyrosinase. To exclude the possibility that oxidation not due to enzymatic action was taking place, controls were employed which were under identical experimental conditions, but which did not contain the enzyme at all, or which contained it in an inactivated (boiled) form. Some oxidation was observed in these controls, but to a much lesser degree.



TYPICAL POISON IVY IRRITANTS

Charles Jordan

These experiments showed clearly that the poison ivy principle could be oxidized to a harmless form in the test tube. The next problem that Dr. Sizer and Clemens E. Prokesch were confronted with was to determine whether or not the reaction would occur on the human skin. A modified patch test that involved the use of a glass ring 1.75 cm. in diameter and .5 cm. high

Vacationists' terror: the three-leafed poison ivy.

was employed. The toxicant was dissolved in ether, the glass ring was placed against the skin of the subject, and the ether solution was poured in. The ether was then evaporated by a current of air. The toxicant was left on the skin for twenty-four hours or until a reaction to the toxin took place.

Each "human guinea pig" in these experiments received two patch tests, one with tyrosinase and one without, as a control. In no cases were the experimental areas worse than the control areas, in four cases no difference was observed, and in thirty-one cases the experimental area showed noticeably less swelling and itching than the control area. There were also subjects which showed no reaction in either the experimental or control areas. This is due to the fact that amounts of toxicant just above the threshold of sensitivity were employed, and thus some "sub-threshold reactions" were to be expected.

In these experiments the toxic principle had already been inactivated by the enzyme in the test tube. However, subsequent experiments showed that tyrosinase is effective in decreasing the severity of a case of poison ivy even when the toxicant has been on the skin for from four to twelve hours before tyrosinase is applied.

These experiments suggest several methods for the treatment of poison ivy, especially in its early stages. The main problem seems to be the penetration of tyrosinase into the inflamed tissues. Experiments are now in progress to determine the effectiveness of injecting sterile tyrosinase into the inflamed tissues. Another answer that has been suggested is the use of a second enzyme, hyaluronidase, in conjunction with the tyrosinase. Hyaluronidase, known as "spreading factor," has the remarkable property of increasing the permeability of tissues, and thus might make the penetration of tyrosinase into sub-cutaneous tissue without resorting to sub-cutaneous injections possible. These measures, if they turn out to be workable, might be the first really effective way of checking poison ivy in its early stages.

Especially helpful in enzyme studies is the Barcroft Differential Respirometer, a versatile apparatus for measuring the evolution or absorption of gases by biological systems. *Dr. I. W. Sizer*

synthetics from oil

New Methods Developed for Catalytic Production of Hydrocarbon Compounds from Petroleum

Marc L. Alfandry, '51

In general, it may be stated that at present any type of hydrocarbon can be converted into any other type by catalytic reactions already established, which are adaptable to commercial production. Thus the foundation has been laid for an improved petroleum industry and for a synthetic chemical industry utilizing petroleum as a raw material for the production of a huge number of synthetic products which heretofore have been known only as coal-tar derivatives; in the future, synthetic hydrocarbons, such as benzene, toluene, xylenes, mono-olefins and di-olefins, acetylene and others used in the production of explosives, dyes, medicinals, perfumes, synthetic rubber, plastics, resins, and many other products, will assume great importance.

An important hydrocarbon catalytic process is the one used for the conversion of aliphatic hydrocarbons into aromatics. The great importance of the successful solution of this problem lies in the value of the aromatics as high antiknock motor fuels, solvents, and as raw materials for explosives (TNT), and a practically endless variety of organic chemicals useful for dye intermediates, pharmaceuticals, medicinals, synthetic resins, etc. This process is extremely important from the viewpoint that a practically unlimited supply of raw material is available in the form of petroleum, whereas the present source of raw materials for aromatic hydrocarbons is coal-tar, of which there is only a limited current supply, since the production of coal tar must be geared to coke requirements.

This country's petroleum industry could easily produce over 40,000,000,000 gallons of gasoline yearly, if the need for it would arise. Based on a yearly gasoline production of only 25,000,000,000 gallons, however, and using but twenty per cent of the gasoline, this country could manufacture about 30,000,000,000 pounds of picric acid, about 27,000,000,000 pounds of trinitrotoluene, and 25,000,000,000 pounds of trinitro-xylene. Thus there are 82,000,000,000 pounds of high explosives potentially available annually from gasoline within the United States for many years to come.

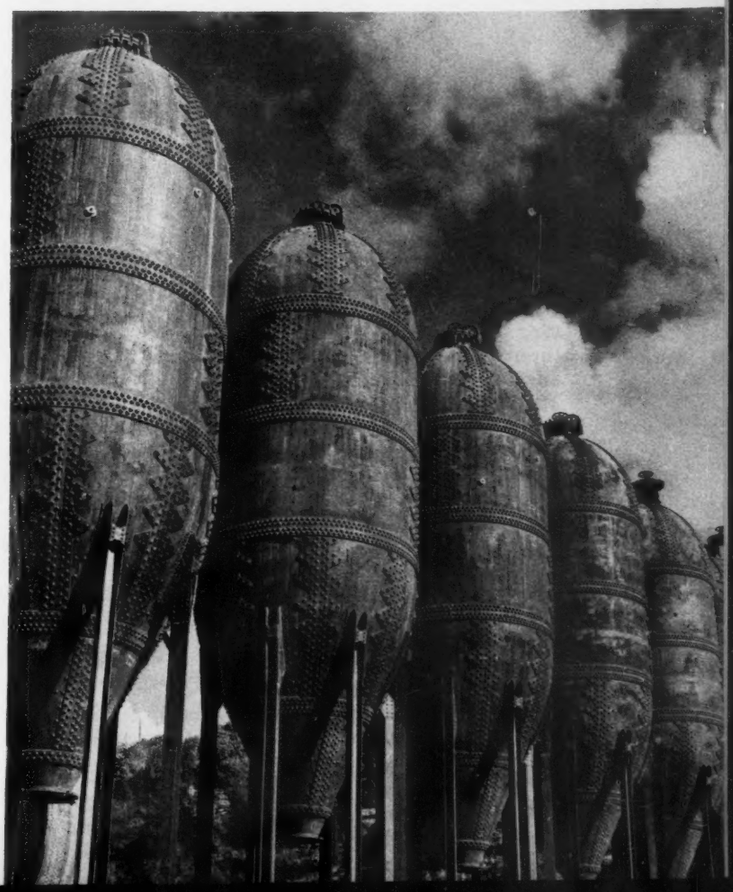
Various approaches to the problem of hydrocarbon conversion have been made by purely thermal cracking processes ever since Faraday's important discovery of benzene in 1825. In these investigations it has usually been assumed that the aromatics are formed via the acetylene or ethylene route, that is reactions of the type $3\ C_2H_2 = C_6H_6$ or $3\ C_2H_4 = C_6H_6 + 3H_2$. However, it has been shown partly from the von Baeyer strain theory (which states that a condition of strain is set up as a result of double linking, bending the two pairs of carbon bonds from their original positions into a straight line joining the two carbon atoms), and partly from other considerations, that paraffin or unsaturated hydrocarbons with six or more carbon atoms in a row, have a natural tendency to form six-carbon atom rings. It is necessary to split off only two hydrogen atoms from two end carbon atoms of the open ring to form a cyclohexane ring which, by further dehydrogenation, is converted into an aromatic hydrocarbon.

Efficient and practical oxide catalysts have been developed containing, in order of their effectiveness, metals of the fourth, fifth, and sixth groups of the Periodic System for the dehydrogenation of straight-chain hydrocarbons to the corresponding olefins. The new reaction, which has been named cyclization permits the more or less quantitative conversion of aliphatic hydrocarbons containing six or more carbon atoms in a chain into the corresponding aromatic hydrocarbons. For instance, a heptane has been converted into toluene with yields of about 75 per cent of the theoretical, *i.e.*, 0.75 mole of toluene for every mole of heptane, in one pass, or approximately 90 per cent on recycling.

It has been found that some of the pure oxides which were not supported on carriers, for instance, chromium sesquioxide (Cr_2O_3) and molybdenum sesquioxide (Mo_2O_3), produce partial cyclization at temperatures of 450–500° C. At higher temperatures they lose their activity very rapidly due to crystallization and are not suitable for practical purposes. The introduction of suitable carriers allows the preparation of active catalysts having a useful life of over a thousand hours.

The catalysts used consisted of minor proportions of the oxides of the transition metals of the sixth

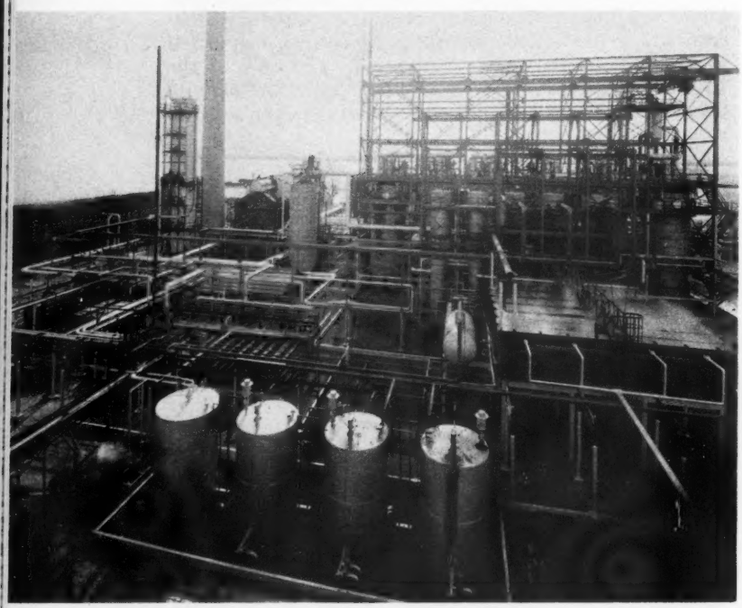
Storage towers



(Cr and Mo), the fifth (V), and the fourth (Ti and Ce) groups of the Periodic System, supported on carriers of relatively low catalytic activity such as, for example, specially prepared alumina or magnesia. Generally, the catalysts are prepared by depositing upon the carriers from aqueous or other solutions; however, they may also be mechanically mixed with the carriers either in the dry or wet condition.

The principle is always to use such a procedure and only such compounds of the dehydrogenating metal as will finally leave only the oxides of the desired metal on the particles of the support without any interfering constituents. Such compounds are usually water-soluble metal nitrates or ammonium salts of the metallic acid. As an example, chromic acid may be used in the case of chromium.

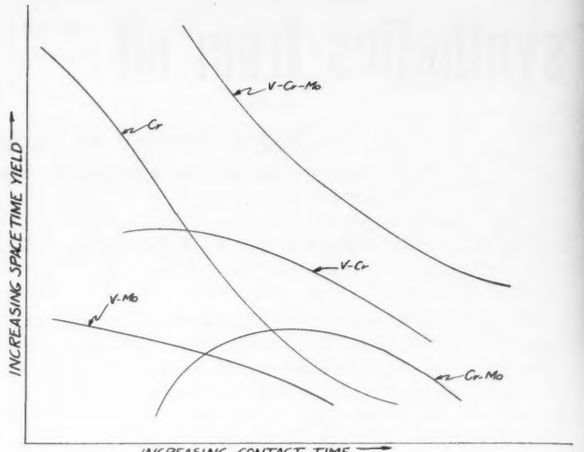
Greater activities of catalysts and larger space-time yields may be attained with mixed catalysts containing two, three, or even more dehydrogenating metal oxides on the supports. The relationship between the activity



A view of catalytic apparatus

and the nature of different metals and their amounts is quite complicated. This relationship is illustrated in the graph for the specific case of dehydrocyclization of heptane into toluene at 500° by mixtures of chromium, molybdenum, and vanadium oxides on alumina. The sum of dehydrogenating metal oxide molecules per 100 molecules of alumina was kept constant in all mixtures. All oxides were introduced by means of the corresponding ammonium metalates.

It may be seen in this particular example that at all contact times a vanadium-molybdenum catalyst shows less activity than the corresponding simple chromium catalyst. However, the chromium-molybdenum and, to an even greater extent, the vanadium-chromium catalyst show



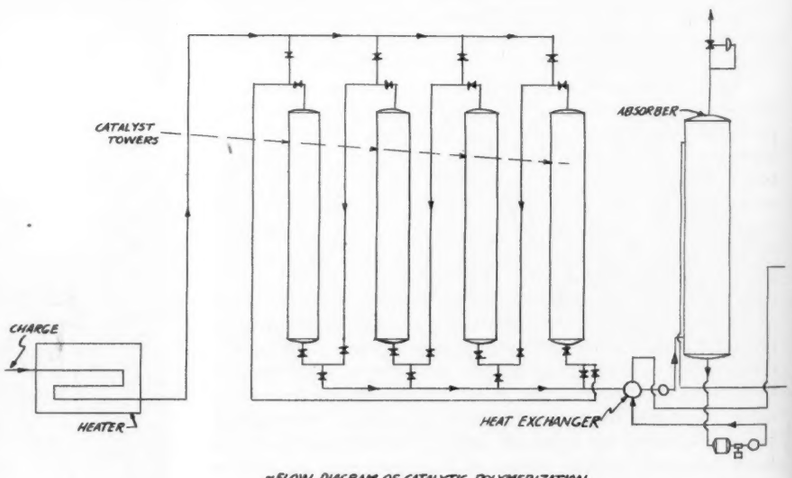
James Cowdery

improved results over the simple catalyst at longer contact-times corresponding to higher once-through yields. The triple molybdenum-chromium-vanadium oxide catalysts show higher activity than the single or any double dehydrogenating metal oxide catalysts. Factors affecting the composition of the products and their yields are the composition of the feed, the chemical composition and physical structure of the catalyst, catalyst activity and life, contact time or space velocity, and the temperature and pressure under which the reaction is carried out.

One of the numerous applications of hydrocarbon conversions lies in the field of synthetic lubricating oils. The lubricants produced by synthesis contain no paraffin wax. An oil prepared by polymerizing a cracked paraffin wax distillate was shown to be equal, if not superior, to highly refined natural lubricating oils with regard to oxidation stability, viscosity index, color stability, and comparative lubricating properties.

Isobutene has been polymerized to form polybutenes, resulting in highly viscous liquids, semi-solids, and solids ranging in molecular weight from 2,000 to 400,000. This work was carried on by I. G. Farben and the Standard Oil Development Co., and was presented before the Boston meeting of the American Chemical Society in September, 1939. It appears that the properties of polybutenes vary in accordance with

(*Continued on page 252*)



~FLOW DIAGRAM OF CATALYTIC POLYMERIZATION UNIT~

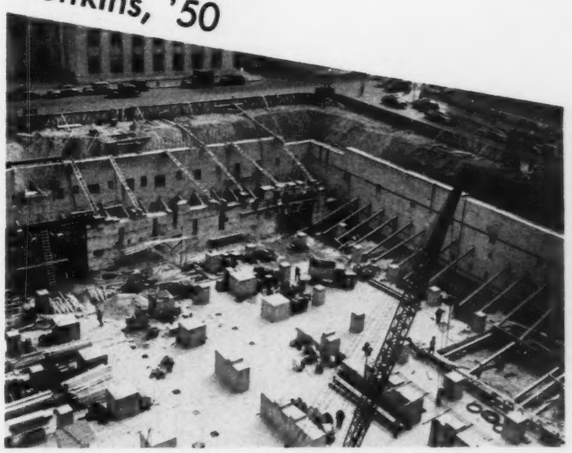
James Cowdery

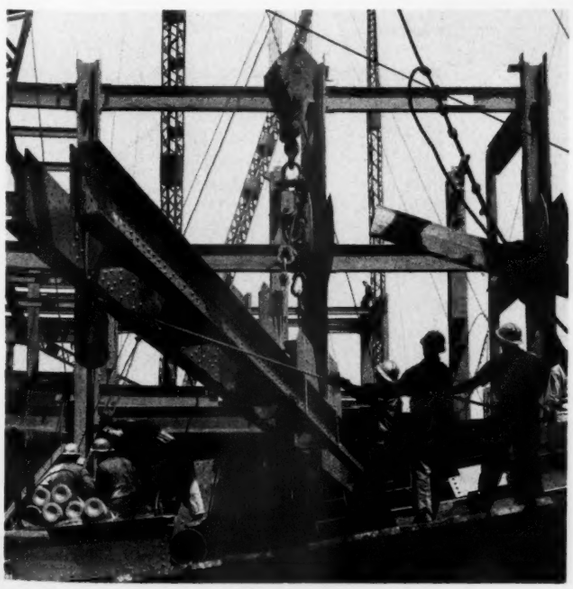
john hancock progresses

Roy W. Jenkins, '50

John Hancock's new home will be the most modern office building in traditionally conservative Boston. It will contain some of the most progressive features ever provided in modern skyscraper architecture and will be an imposing addition to Boston's scanty skyline (see top of page).

It can now be definitely stated that, when completed, the building will be the highest n the city. The height of the Custom House Tower, previously the highest, is 505 feet, as determined by the United States Coast and Geodetic Survey. This new addition to the Home Office of the John Hancock Mutual Life Insurance Company will rise 509 feet above sea level according to the architects, Cram and Ferguson.

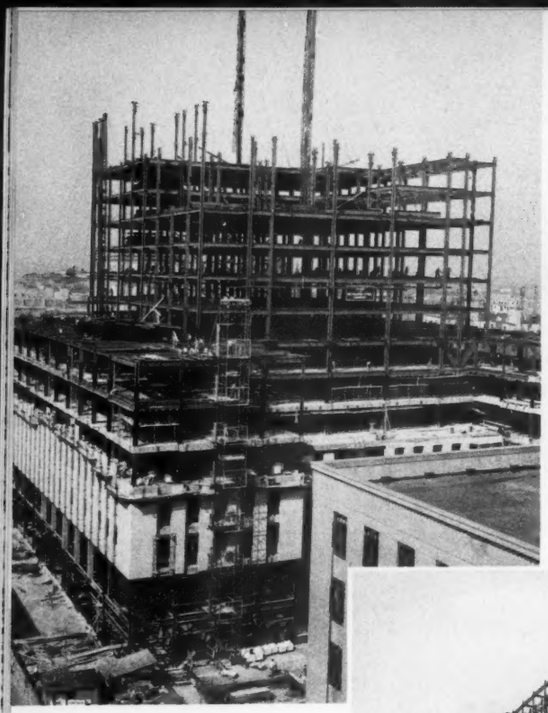




The March, 1947 issue of TECH ENGINEERING NEWS presented a report on the construction of the foundation of the building. At that time, after more than a year of pile driving and excavation, the actual building was still below street level, as shown above.

Early in May, 1947, the erection of over 13,000 tons of structural steel was started; on November 17, the Company flag was raised on the top of the lantern tower to symbolize the completion of the steel work. Five days later the incessant clatter of the riveting hammers was ended when the last of the estimated 216,000 rivets was driven.

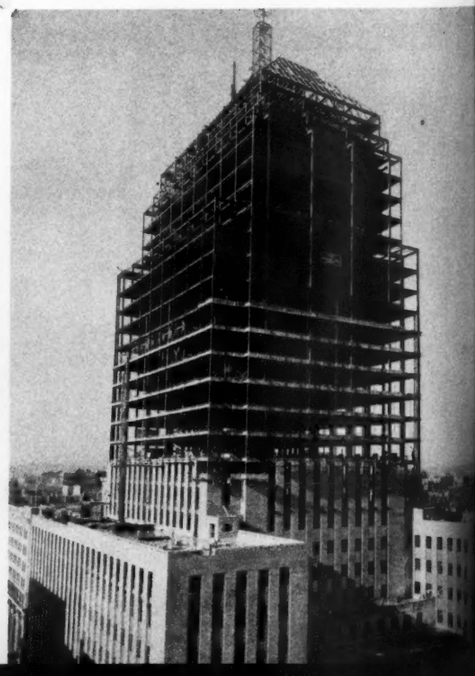
At this writing, over 900 men are working on the building, doing the million and one tasks that must be done before the structure will be ready for occupancy sometime in 1949. Cram and Ferguson are the architects and engineers and the Turner Construction Company, with M. H. Parsons as project manager, are the builders.



The John Hancock Company flag is raised on the top of the steel framework to symbolize the completion of the steel work. On the right is a sketch of the lantern tower when completed. It is to be surmounted by a television antenna of as yet undetermined height.

This sequence of four pictures were taken approximately twenty-five to thirty working days apart. Notice how work on the concrete floors follows closely behind the erection of the steel, and similarly, the setting of the Berea sandstone follows the floor construction. The erection of the polished granite, which was quarried at Somes-Sound, Maine, was postponed to permit easy access to the first floor and also to prevent it being scratched or defaced by the steel which was removed from trucks on the street.

When this auditorium is completed, it will seat 1132 people. It is patterned on a small scale after the Radio City Music Hall.



more interesting facts

The entire 26-story structure will be completely protected from lightning charges. Copper cables have been fastened to the tops of the steel piles, carried through the concrete foundation and fastened to the steel framework.

A radiant heating system will be installed in the sidewalks adjacent to the building to facilitate removal of snow and ice.

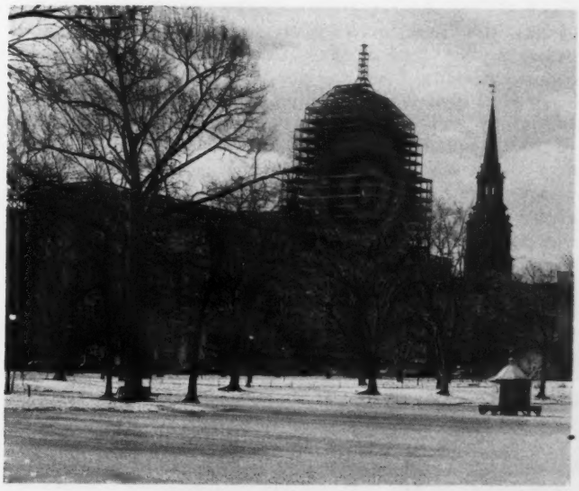
More than 30 million cubic feet of air will be supplied to the offices by the air-conditioning system.

Westinghouse electric stairways will handle the normal flow of traffic for the first eight floors. These electric stairways have a rated capacity of 8,000 passengers an hour and may be reversed to double the capacity during rush hours in the morning and evening.

The 18 Otis elevators will be the fastest in New England with a speed of 800 feet per minute.

The windows are of Thermopane and will open outward on a horizontal plane, eliminating the necessity and risk of window washers having to get outside the windows.

From the observatory on the twenty-sixth floor, it will be possible to see 25 miles to sea and 65 miles inland on a clear day.



the story of an unobservable

A Short History of the Ether of Space

H. H. Lanier, '48

I once lived on a floating island in the middle of a large ocean; there were many islands in this ocean, but my story will concern only two others. I will call my island E and the other two S and M. There must have been some whirlpools in this ocean because my island spun around itself and rotated around S, and M rotated around E, and S rotated around I don't know what. I never saw but one side of M and it looked like a friend, but that was funny to me for how could an island be a friend?

Now on my island there were lots of friends and we threw little packages of decs at each other all the time. The decs didn't hurt usually, in fact they sometimes made us feel good all over. There were also some not so friendly friends who lived on the other side of the island. Some of my friends thought the reason they weren't friendly was that they couldn't catch the decs we threw at them, and we couldn't catch the decs they threw at us.

On my island there were also many friends who could throw decs better and faster than others. I knew some of them, but lots had gone to other islands evidently, because they weren't around. These good decs throwers were also good scratchers and had left their marks on the sandy beach.

E had spun around many times before I came upon it and lots of friends had scratched in the sand. Many of the friends had made scratches in the sands that looked like, "How can we make scratches in the sand?" Others had made scratches in the sand that looked like, "How can we make scratches in the sand look like decs bounced by the island?" Finally a group of the friends agreed the only way to make good scratches in the sand was to make them look like the island when they threw decs at it. The good scratches were put on blocks of clay and these blocks were copied and sent over the island to be stored in caves. Friends that came to our island then could bounce decs off the clay blocks and learn how decs would bounce off the island.

Many spins ago a group of friends began throwing decs and making scratches about the island S. Now it was known that S was the island where the chickens grew. The chickens always left S and came to E, except when M was in the way. Our dec-bouncing friends had two scratches that looked like a chicken, but they couldn't find which was the good one. One of the scratches looked like the ocean when the wind was blowing, and the other looked like the beach when you had only the smallest part. Finally the scratch that looked like the ocean was called the good one because if a chicken went through a small piece of nothing surrounded by a large piece of something the chickens came out looking like the ocean when the wind was blowing.

Now Max was a good decs bouncer and also made good scratches. Max liked chickens very much and made scratches that not only looked like a chicken but showed how fast the chicken could run. Max also showed that the swiftness of the chicken was determined by how much something we could put into nothing. Max also made scratches that looked like the only way chickens could get from the island S to the island E was to run through the something that was inside all the nothing. The scratch for this something was "Aether." Max scratched this because he knew chickens couldn't swim.

A few spins later Hez made some small chickens and showed that Max's scratches were good ones. Hez made the chickens by combing his hair when there wasn't a lot of ocean around.

Many of the friends tried to bounce decs off this Aether but two of them, M and M, were the best at not bouncing. Our friends threw decs between each other very rapidly after this. They finally decided that their standard of dec bouncing made one scratch when pointed toward the ocean and a different scratch when pointed along the beach. The reason for this was that the island was held together by a scratch that looked like when we combed our hair. Two friends, Lor and Fit, made these scratches at about the same spin.

After a very few spins Mr. E. made some good scratches. Mr. E. had to spend most of his spins bouncing decs off other people's scratches and only had spin to scratch when he should have been eating. Mr. E. didn't bounce decs off the island very much but he changed lots of scratches, even those on the clay blocks.

Mr. E. made scratches that looked like two running friends making the same scratches. One friend was just as good as another friend. Friends had to use chickens to throw decs and chickens would run away from one friend just as fast as it would run away from another friend. If friend one pushed friend two, friend two became harder to push because he got fatter. Even with the help of friend one, friend two couldn't catch up with a chicken.

Mr. E. also made scratches that looked like friends couldn't bounce decs off the Aether so why not throw the clay block in the ocean, and the friends did.

Mr. E. also scratched that the sand was the same as picking up the sand, only more so. Some spins later, this scratch became very important and now looks like what our island needs more of is less friends.

* Dec — a quantum of information, a decision, a yes-no, according to N. Wiener's "Theory of Information."

automotive chassis design

Helmut Weber, '50

The modern motor car has been undergoing constant development since its invention only a half-century ago. Much has been done since that time to improve both efficiency of operation and comfort of ride. Engineering science has been employed to its fullest extent to produce in the car of today maximum efficiency of operation coupled with maximum comfort in riding and has changed the automobile from a luxury available to only the rich to a near necessity in the eyes of Americans. Here we will consider the effect of a few principal chassis constructions on the qualities of comfort of ride.

The frames of passenger cars are made of channel section sheet steel. The sections are of low carbon steel composition and decrease in height from the center to both ends of the frame for elasticity. For torsional strength a center section X-member of I-beam or channel section structure is almost universally employed. Because individual front wheel suspension requires great rigidity, the entire frame tapers in width toward the front.

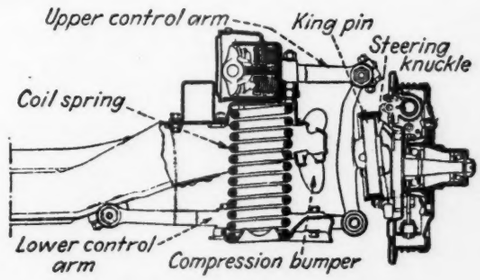
In years past, the body was relied on to add rigidity to the frame; but such a practice added little strength, and the reverse design plan is used today. Also today, there is a trend toward the unification of the body and frame into a single unit. This structure affords a shift in the weight distribution away from a concentrated type of pattern and increases the moment of inertia of the frame-body unit.

A maximum moment of inertia in a passenger car is essential in minimizing the pitching motion given to the car by road shock. The relationship between angular impulse and change in momentum is given by,

$$JL = I\omega$$

and for a given impulse of road shock, ω (and hence the pitching effect) is decreased as I is increased. If the radius of gyration (K) is made equal to $\sqrt{Ld}$ (where L is the distance between axles and d is the distance of either axle from the center of gravity), the vibration of the car would be pure harmonic or vertical motion over the axles. If $K = \sqrt{Ld}$, either axle can be considered the instantaneous axis of rotation and the other the center of percussion, and the impulses transmitted through either axle will have no tendency to move the other. When the radius of gyration is less than this distance, a combination of oscillatory motions over each axle results, creating an uncomfortable pitching motion.

A diagram of the front suspension of a passenger car.



In actual practice the ideal condition is not attained, because it would involve the placing of a considerable portion of the mass ahead of the front and back of the rear axles, and because a design of this type involves difficulties of construction. But in the modern car the radius of gyration is made as long as possible and is between eight-tenths and one times the ideal distance.

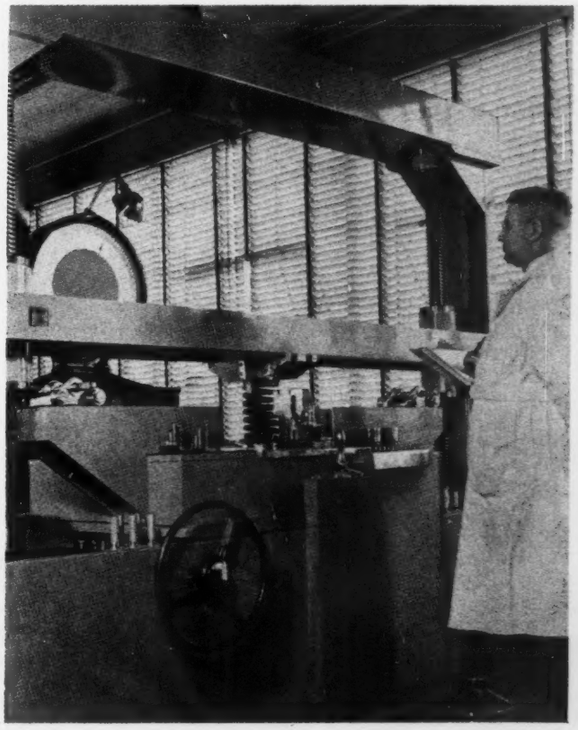
Wheel suspension is also closely tied in with the moment of inertia in creating comfort of ride. Just as vertical harmonic vibration is more comfortable than random oscillatory vibration, so is a lower frequency of that vibration more comfortable than a higher one. Frequency is given by the formula,

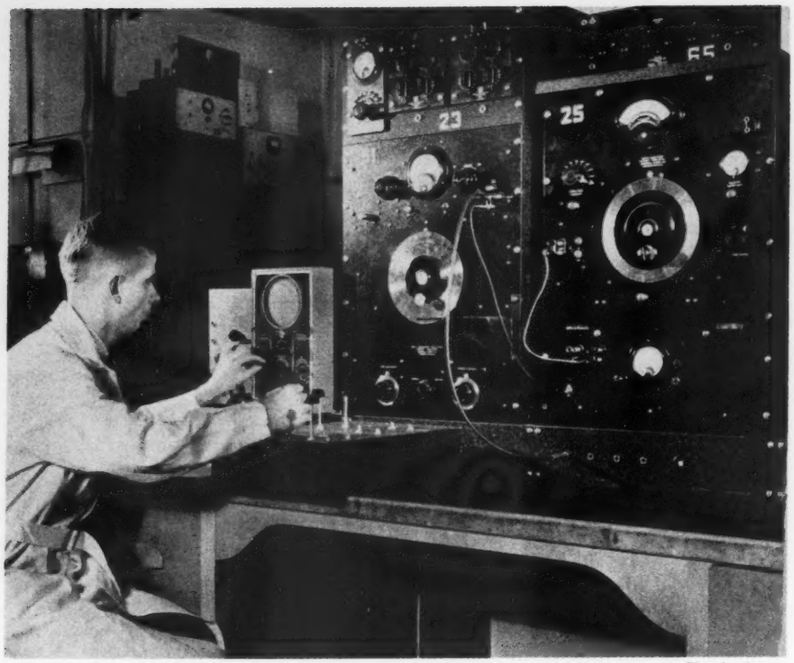
$$f = \frac{1}{2\pi}\sqrt{\frac{mgl}{I}}$$

and it is seen that an increase in I decreases f.

This frequency is set up by the spring suspension system which transmits road shock through the wheels and springs to the frame. In the modern car the front wheels are individually suspended from the frame by coil springs and the rear wheels on a rigid axle by half-elliptic leaf springs. A few of the modern cars employ four wheel coil spring suspension. Coil springs have advantages over leaf springs in that under compression they are subjected chiefly to torsion rather than compression, tension, and torsion combined, as in the leaf springs; in addition coil springs store much more energy per unit volume than do leaf springs. But the leaf springs control the direction of motion in the cushion-

Capacity test of coil or leaf springs *Chrysler Corp.*





Chrysler Corp.

Electronic equipment including a cathode ray tube is used to help determine the motion the automobile will have on the road.

ing of shock, whereas coil springs require the use of radius rods and sway bars to direct the motion of the wheels relative to the chassis. The back springs are shackled to the frame at their rear and pivoted at the front. In the Hotchkiss drive the rear axle is securely bolted to the springs and the springs transmit the thrust and carry the torque reaction.

The front wheels are suspended from the vertical member (steering knuckle support) of a three link system which is pivoted between the upper and lower members or control arms. (Figure 1.) The latter two members are usually parallel but of unequal length so as to give little or no side motion of the wheel. Side motion must be avoided to permit free tie-rod operation and prevent tire scuffing. Between the lower control arm and the frame the coil spring itself is mounted to absorb road shock.

With only the springs to absorb road shock, the frequency and amplitude of vibration set up in the frame would be too great for comfort; therefore, a dampening effect is needed to slow the frequency and decrease the amplitude. For this purpose modern cars are equipped with four hydraulic shock absorbers which are connected in various ways between the spring assemblies and the frame. In Figure 1 the shock absorber is incorporated with the end of the upper control arm.

In early cars various types of friction and spring shock absorbers were employed. One common type consisted of metal discs held in contact with each other by springs. The arm from one disc was connected to the frame and the arm from the other to the spring. Whenever the spring was depressed, the friction between the discs served to dampen the motion. But since the dampening was constant during both compression and rebound, it served only to stiffen the spring.

Present-day shock absorbers are of the hydraulic type consisting of one or more cylinders filled with a fluid and fitted with pistons. The pistons force the fluid through small throttling orifices on the rebound of the spring. In this way the spring absorbs the initial shock more fully and yet is prevented from high frequency and large amplitude of vibration by the dampening effect on the rebound. On compression the fluid passes back through a one-way valve which is larger than the throttling orifices, minimizing the dampening action.

The dampening action is directly proportional to both the velocity of rebound and the viscosity of the fluid used in the shock absorber cylinder. (To keep the viscosity independent of atmospheric conditions a thermostatic control device is provided with each unit.) And since the greater the velocity of initial compression the greater is the dampening action, the shock absorber maintains a frequency which varies but slightly for any road shock.

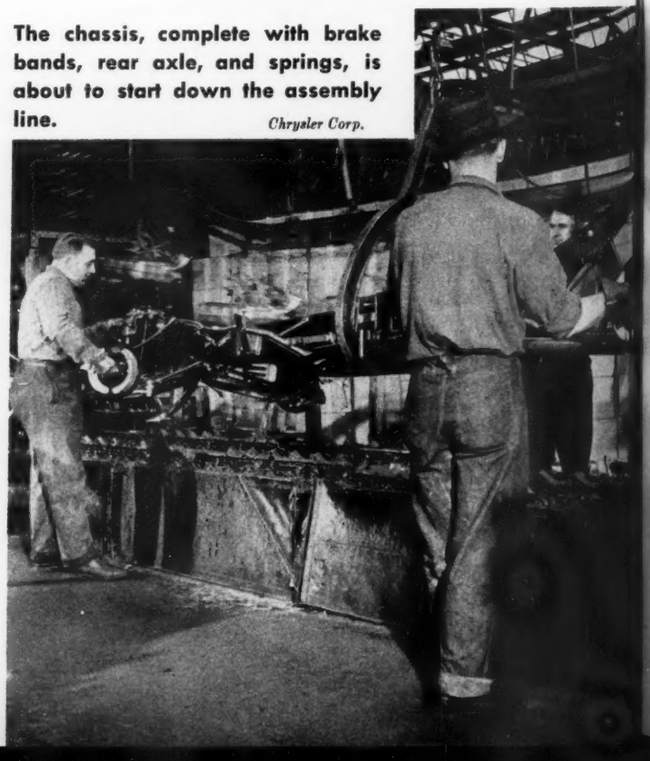
Some further study is necessary before the effect of chassis construction on comfort of ride is more completely determined. The weight and the location of the center of gravity of the car must be taken into account. It seems obvious that a heavier car rides more smoothly than does a lighter one. That fact is shown in the formula,

$$\int F\,dt = mv$$

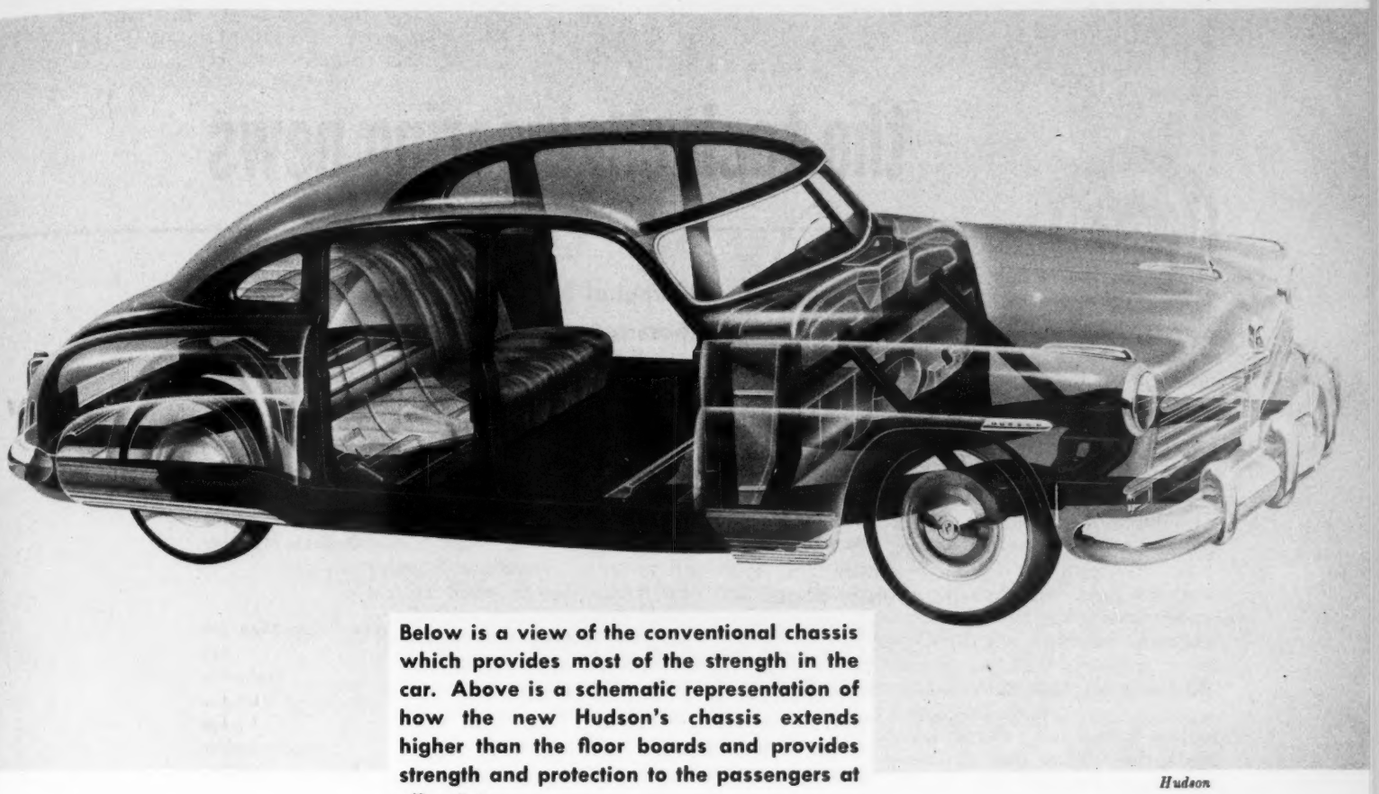
which gives the relation between the impulse given to a body and the change in momentum. In this case the impulse from road shock is transmitted to the car through the springs, and the greater the mass the smaller is the velocity imparted to the car relative to the wheel suspension. Consequently, the heavier car travels more smoothly over the road.

The effect that the location of the center of gravity has on the operation of the car is considered from the

(*Continued on page 258*)

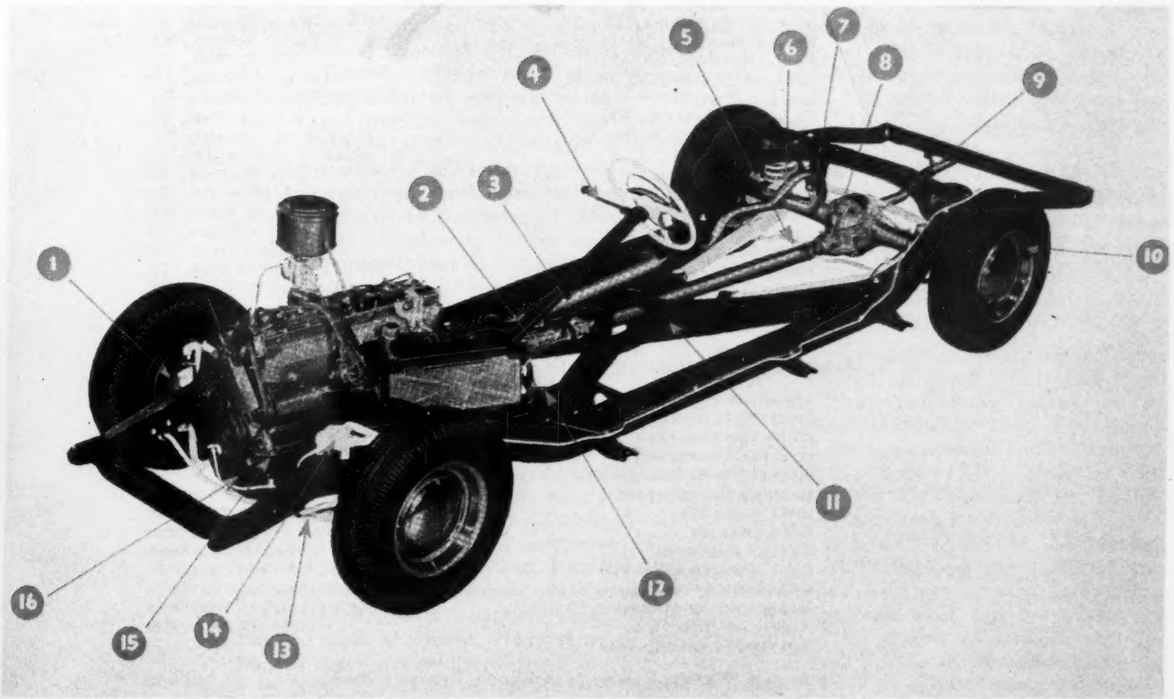


The chassis, complete with brake bands, rear axle, and springs, is about to start down the assembly line. *Chrysler Corp.*



Below is a view of the conventional chassis which provides most of the strength in the car. Above is a schematic representation of how the new Hudson's chassis extends higher than the floor boards and provides strength and protection to the passengers at all points.

Hudson



1. Self-Energizing Super-Hydraulic Brakes, with Cast Iron Braking Surfaces and Triple-Sealed Drums. 2. All-Silent Syncro-Mesh Transmission. 3. Needle-Bearing Front Universal Joint. 4. Handi-Shift Gear Control. 5. 4-Way Stabilization. 6. Modern Coil Springs at all four wheels. 7. Flanged Axle Shafts. 8. Needle-Bearing Rear Universal Joint. 9. 7-Bearing Rear Axle with Hypoid Gears. 10. Mechanical Emergency Brakes operating on Rear Wheels. 11. Rigid X-Member Frame with 5 cross members. 12. Single-Plate Smooth-Action Clutch. 13. Knee-Action Front Wheels. 14. Double-Action Hydraulic Shock Absorbers at all four wheels. 15. Center Unit Front-End Mounting. 16. Dual Center-Control Steering.

Oldsmobile

the tech engineering news

Professional Journal of the Undergraduates of the
Massachusetts Institute of Technology

Managing Board

EDWARD M. KOSOWER, '49 . . . . . General Manager
EDWARD T. MILLER, '49 . . . . . Editor-in-Chief
GUIDO J. FRASSINELLI, '48 . . . . . Managing Editor
WILLIAM R. BOHLMAN, '49 . . . . . Business Manager

Junior Board

EDWARD A. MULLERY, '48 . . . . . Advertising Manager
CHARLES M. JORDAN, '49 . . . . . Art
ROY JENKINS, '50 . . . . . Make-Up
MARIO DIQUILIO, '48 . . . . . Circulation Manager
JAMES BUCK, '49 . . . . . Sales
HARRISON C. WHITE, '50 . . . . . Literary Editor
RALPH JOHNSTON, '50 . . . . . Literary Associate

Staff

CLARK ABT, '51
RICHARD AHEARN, '50
MARC L. ALFANDRY, '51
FRED BERGMANN, '50
FRED DIAMOND, '50
STANLEY FLEISIG, '50
LOUIS GALAN, '51
CLARENCE GREGORY, '51
WERNER H. GUMPERTZ, '48
JOSEPH HODNICK, '51
KENNETH KOPPLE, '51
PETER M. LANG, '51
LAWRENCE LORTSCHER, '51
JERRY LEVINE, '51
IRWIN MANNING, '51
EMERINO MARCHETTI, '51
FRANCIS B. MCKEE, '51
CHARLES MILLER '51
JOSEPH MIANO, '51
ROBERT J. MUZZEY, '50
MARK NELKIN, '51
PETER NEY, '51
LEONARD NIPPE, '50
WILLIAM PRICE, '50
LEO SARTORI, '50
CHARLES K. SHRAMM, '51
HARRY F. SMITH, JR., '51
MYLES SPECTOR, '50
WALTER STAHL, '51
STUART STEIN, '51
DAN SULLY, '51
ROBERT VIDAL, '49
HELMUT WEBER, '50
ROBERT B. WOLF, '50
CASPER ZUBLIN, '51

Member Engineering College Magazines Associated

ARKANSAS ENGINEER
CINCINNATI COOPERATE ENGINEER
COLORADO ENGINEER
CORNELL ENGINEER
DREXEL TECHNICAL JOURNAL
ILLINOIS TECHNOGRAPH
IOWA ENGINEER
IOWA TRANSIT
KANSAS ENGINEER
KANSAS STATE ENGINEER
KENTUCKY ENGINEER
MARQUETTE ENGINEER
MICHIGAN TECHNIC
MINNESOTA TECHNO-LOG
MISSOURI SHAMROCK
NEBRASKA BLUEPRINT
NEW YORK UNIVERSITY QUADRANGLE
OHIO STATE ENGINEER
OREGON STATE TECHNICAL RECORD
OKLAHOMA STATE ENGINEER
PENNSYLVANIA TRIANGLE
PENN STATE ENGINEER
PURDUE ENGINEER
ROSE TECHNIC
TECH ENGINEERING NEWS
WAYNE UNIVERSITY ENGINEER
WISCONSIN ENGINEER

JOHN A. HENRY, University of Illinois, Urbana, Illinois — Chairman
LITTELL MURRAY BARNHILL, INC. — Publisher's Representative
101 Park Avenue, New York
605 North Michigan Avenue, Chicago

the dragon's den

The Honor System

Recently the honor system has been tried in a few Freshman sections. Many of the values attributed to the system are based on its character building aspects and the wonderful thing it is to be able to lay claim to the fact that in your school students can be trusted. However, the evaluation should not end with these generalities. Immediately one thought comes to mind. Could it be that in schools where the honor system really works and *none* of the students engage in what is customarily called cheating, the degree obtained has no real financial value and the students do not have enough work actually to keep them very busy? This is not to take a completely degrading view of the honesty of most men, but to recognize the fact that, on the whole, college-age men will judge for themselves. When there is great incentive to achieve a goal, a certain number will try to get there, if necessary, on other than their own merits.

Most, we hope, would rather flunk out than cheat on an examination, but we must recognize the fact that there will be a few who cheat, especially if there is a strong reason for not flunking out. Among these strong reasons can be placed the financial question. An M. I. T. degree is worth something. However, we also realize that cheating is not limited to the students near the passing level. But the explanation that there is considerable incentive to obtain a goal, in this case high marks, still stands.

Here we must admit that we have overlooked one consideration. The honor system is not necessarily designed to do away with the desire to cheat. It may merely substitute student policing for faculty policing. Then the honor system is no longer a matter of character building, but a matter of getting the least cheating with the minimum of bad effects.

In the first place what is cheating, and how far do its boundaries extend? Do copying and other less drastic measures for getting homework problems, lab reports, or themes done imply cheating? We wonder how original work must be to be called original.

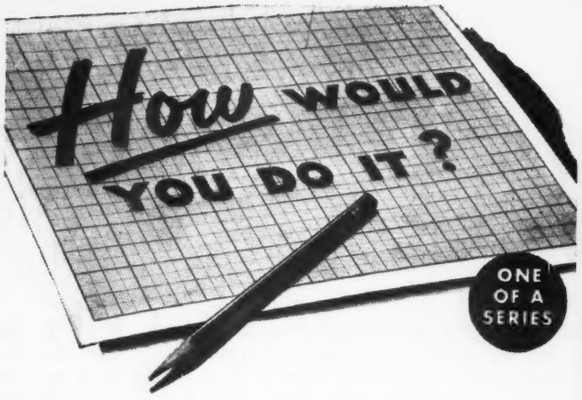
There are undoubtedly a few students at Tech who need to be trained in practicing greater honesty. There are a great number who, more than anything else, need to be taught the spirit of cooperation and teamwork. Outside of school there are very few individuals working successfully by themselves. Most of us will be expected to become part of teams. The honor system would hardly prepare us for that.

Of course, we are not suggesting that quizzes and examinations should be team affairs. But perhaps team work could well extend beyond the mere taking of data in the laboratory. We are unable to frown upon those who extend their cooperative spirit to the written reports. It all adds up to the need for a change from the outlook that other students are a potential threat to the feeling that they are truly fellow students. The honor system is not a step in that direction.

Our Governing Body

Of late the Institute Committee has been busy in an effort to improve its constitution. The purpose is that of making the organization more efficient. A grand idea — but there is more to the trouble than the Constitution. All the blame cannot be placed on an indifferent student body. Any effort to divorce the Institute Committee from dependence on the student body will not solve the problem, and should not be acceptable to the students. Why is the Institute Committee somewhat of a joke among many of those students who have attended meetings either as a member or as a listener? One reason might be the inefficiency with which the Committee functions in meetings. This inefficiency is not in any way caused by the Constitution. Meetings do not drag out till late in the evening because of the Constitution, but because of conduct within the meeting. The all too prevalent wasting of time causes many of the more busy members to stay away from meetings. A few constructive ideas which might or might not work but are worthy of consideration are these: Have more of the arguments for or against an issue in writing. Such a scheme would lend itself to conciseness and prevent a little of the talking around a subject. The issue at hand would remain at hand. The Executive Committee should, with proper thought, foresee the debatable issues, and look for the trivial little snags which, when brought up from the floor, bring matters to a standstill. With proper steering by the Executive Committee debate might proceed more speedily on the issues under consideration, and members might more strictly adhere to the general rules for parliamentary procedure.

E. T. M.



PROBLEM—You are designing a cabinet-type oil heater. The oil and air metering valve has to be placed at the bottom. You now want to provide a manual control for the valve located on the cabinet front where it is easy to see and to operate. How would you do it?

THE SIMPLE ANSWER—Use an S.S.White remote control flexible shaft to connect the dial to the valve or to a rod running to the valve. The latter method was used in the heater illustrated below. The flexible shaft will provide smooth, sensitive control and will allow you to put the dial anywhere you want it.

Photo courtesy of Quaker Mfg. Co., Chicago, Ill.

★ ★ ★

This is just one of hundreds of power drive and remote control problems to which S.S.White flexible shafts are the simple answer. That's why every engineer should be familiar with the range and scope of these "Metal Muscles"* for mechanical bodies.

*Trademark Reg. U.S. Pat. Off and elsewhere

WRITE FOR BULLETIN 4501

It gives essential facts and engineering data about flexible shafts and their application. A copy is yours free for asking. Write today.

S.S.WHITE INDUSTRIAL DIVISION
THE S. S. WHITE DENTAL MFG. CO.
DEPT. C, 10 EAST 40th ST., NEW YORK 16, N. Y.
FLEXIBLE SHAFTS • FLEXIBLE SHAFT TOOLS • AIRCRAFT ACCESSORIES
SMALL CUTTING AND GRINDING TOOLS • SPECIAL FORMULA RUBBERS
MOLDED RESISTORS • PLASTIC SPECIALTIES • CONTRACT PLASTICS MOLDING
One of America's AAAA Industrial Enterprises

A GLOWING TRIBUTE TO CABLE FITNESS

Is a cable covering flameproof? Will it resist high temperatures when it comes to actual service?

Long before a cable is manufactured, questions like these are answered in the Okonite laboratories, proving ground and in various testing departments of the Okonite plants. The picture above shows a flame test. The measured current that makes the coils glow makes it possible to reproduce test after test without variation. The Okonite Company, Passaic, New Jersey.

OKONITE OKONITE SINCE 1878 5230
insulated wires and cables

synthetics from oil

(*Continued from page 242*)

their molecular weight. The lower polymers, such as dimers and trimers, are liquids. The intermediate polymers are clear, sticky and viscous fluids. The higher polymers are ordinarily white, tough, and elastic solids. The polymers having a hydrogen-to-carbon ratio of two are odorless and tasteless when pure and have a specific gravity of approximately 0.9, subject to slight variations with changes in molecular weight. The products are very stable and resistant to heat and light, as well as to strong acids and alkalies at ordinary temperatures. They are also stable towards oxygen and ozone. They are soluble in the hydrocarbons, and chlorinated hydrocarbons, but are generally insoluble in oxygenated solvents such as methyl alcohol, acetone, and methyl acetate, and low molecular weight ethers.

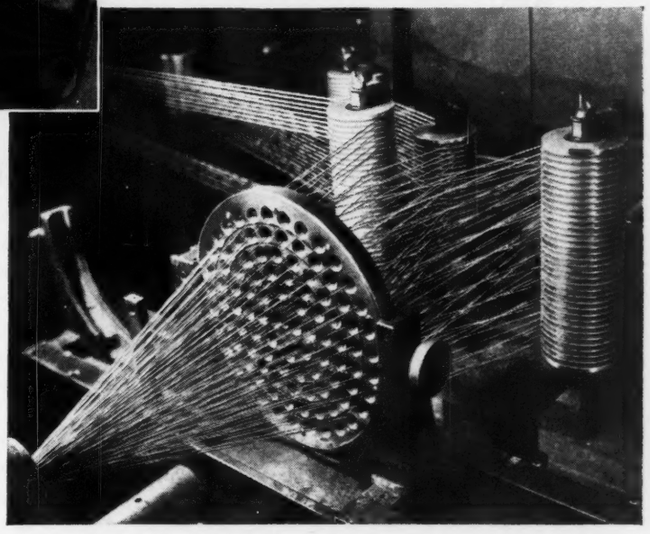
The properties of polybutenes make them useful for coating high-tension cables, improving the viscosity index of lubricating oils, and for blending purposes where it is desirable to impart their particular properties to the material to which they are added, for example, in greases, textile lubricants, paraffin wax, asphalt, and many other substances. The addition to a paraffin wax, for example, results in reducing brittleness and cracking at low temperatures. Other uses of polybutenes are in motor fuel, cosmetics, and medicinal preparations.

NUMBER 10 OF A SERIES

Newsworthy Notes for Engineers

"Merry-go-round" speeds telephone dial governors

Most production lines in Western Electric plants follow standard practices, but often it is advantageous to custom-tailor an assembly line to do a specific job better. To control the mass production of delicate telephone dial governors to exacting standards, Western Electric engineers designed this "merry-go-round" conveyor with its ingenious assembly fixtures. It both simplifies the operation and reduces the time of assembly.



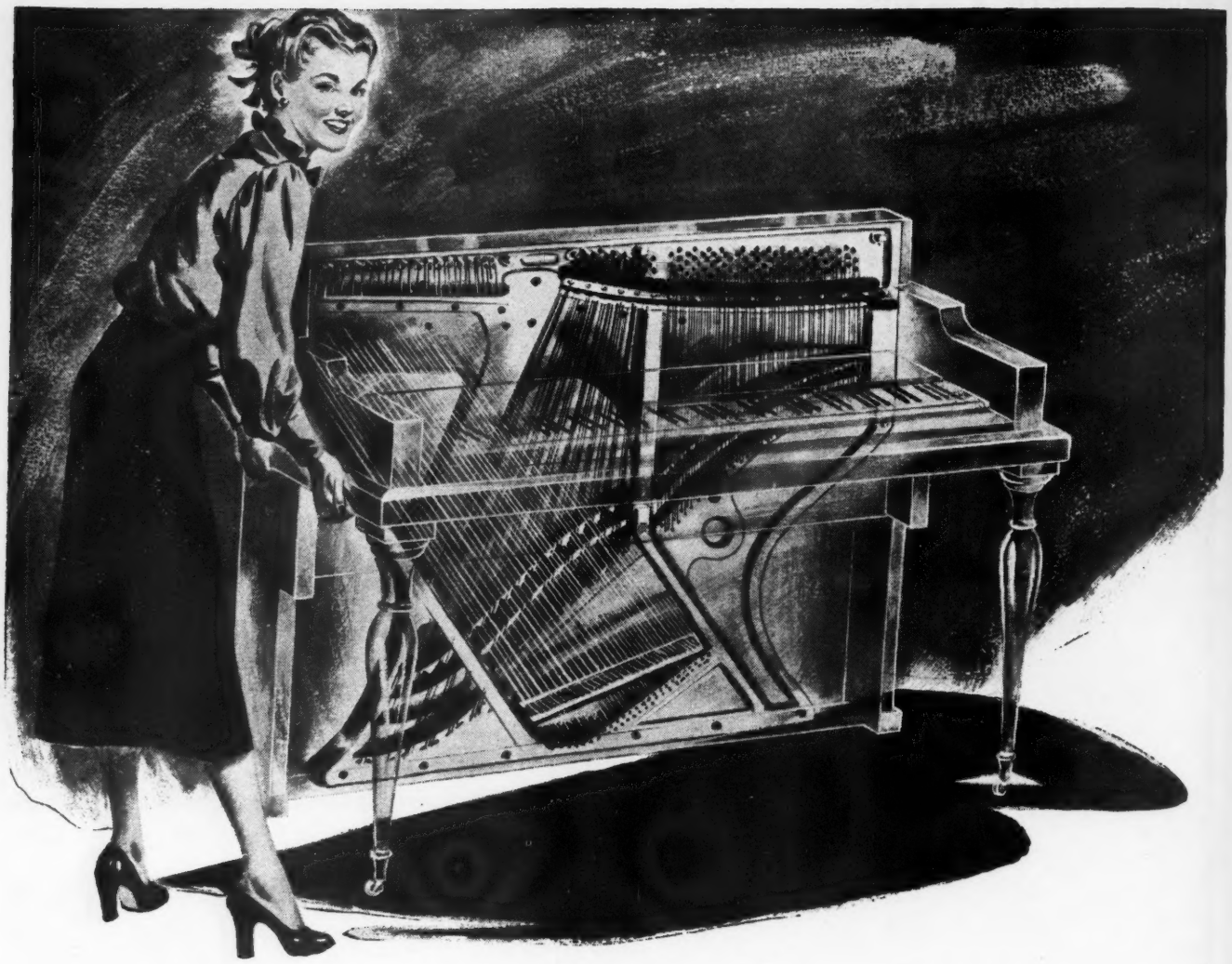
Cable at the "Cross Roads"

This "Cross Roads" guide plate through which pulp-insulated wires are rushing, keeps the wires in their proper relative position while being twisted into units of 101 pairs before being fashioned into a telephone cable. The wires passing through the guide plate to the flyer strander are kept at a uniform tension by means of a torque motor and a very sensitive control device at each of the 101 supply reels. Designed by Western Electric engineers, this mechanism prevents defects by keeping the wires from being stretched as they move along.

Engineering problems *are many and varied at Western Electric, where manufacturing telephone and radio apparatus for the Bell System is the primary job. Engineers of many kinds—electrical, mechanical, industrial, chemical, metallurgical—are constantly working to devise and improve machines and processes for mass production of highest quality communications equipment.*

Western Electric

A UNIT OF THE BELL SYSTEM SINCE 1882



The Piano Business Gets a LIFT... when Alcoa Aluminum Castings Replace Heavy Metal

Even a well-trained husband who'll rearrange the living room every Spring balks at piano-moving. You can see the main reason above. It's the big metal plate that holds the strings—and it has always tipped the scales at around 125 pounds.

No wonder it gave the piano business a *lift* when a progressive piano builder replaced the heavy iron plate with one weighing 45 pounds—made of Alcoa Aluminum. As perfected, this big casting from our foundries is strong to resist the 18-ton pull of the taut strings. It is stabilized to provide tonal quality and stay in tune. And its cost today is competitive with the old-fashioned cast-iron plate.

With other advantages, in other industries Alcoa Castings are effecting similar changes. In one plant, their corrosion resistance means no painting, simple finishing. In another, they are liked for their superior machinability. In still another, they are preferred for the ease with which they swing through production, where iron castings had to be hauled by truck or hoisted on heavy cranes.

The change from heavy metal castings to Alcoa Aluminum Castings is a revolutionary switch in product engineering. Old, old habits are being questioned as engineers re-evaluate metals—with a sharper eye than ever before focused on Alcoa Aluminum. ALUMINUM COMPANY OF AMERICA, Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA FIRST IN **ALUMINUM**

ALCOA ALUMINUM 1888 1948 60 YEARS OF SERVICE

Just 60 years ago six young men started a tiny business in a little shed in Pittsburgh. They began to make aluminum by a new process. That was the beginning of what is now Alcoa. Alcoa's aim, then and now, was to make aluminum cheaper and more useful. How successfully that has been done is shown by the fact that America today has the greatest aluminum industry in the world, employing around 1,000,000 people in the manufacture of aluminum in its many shapes and forms or in making many useful products in which aluminum plays an essential part.

One man—serving all three —saves your time

For more than twenty years Carbide and Carbon Chemicals Corporation has maintained a staff of technically trained representatives to serve its customers throughout the country. Now, more than ever, this policy means time and effort saved for you.

Every Carbide representative is a graduate chemist or chemical engineer. This basic technical knowledge, plus research experience in our laboratories, special training in our home office, and practical knowledge gained in the field, gives our representative the background needed to be of assistance to all three, the men in your plant, your laboratory, and your purchasing department.

When you have problems involving the use, development, or purchase of chemicals, call our nearest office and discuss them with a Carbide representative. And if you would like a copy of our catalog, "Synthetic Organic Chemicals," please address Department "A."

CARBIDE and CARBON CHEMICALS CORPORATION

Unit of Union Carbide and Carbon Corporation

30 East 42nd Street UCC New York 17, N. Y.

Offices in Principal Cities

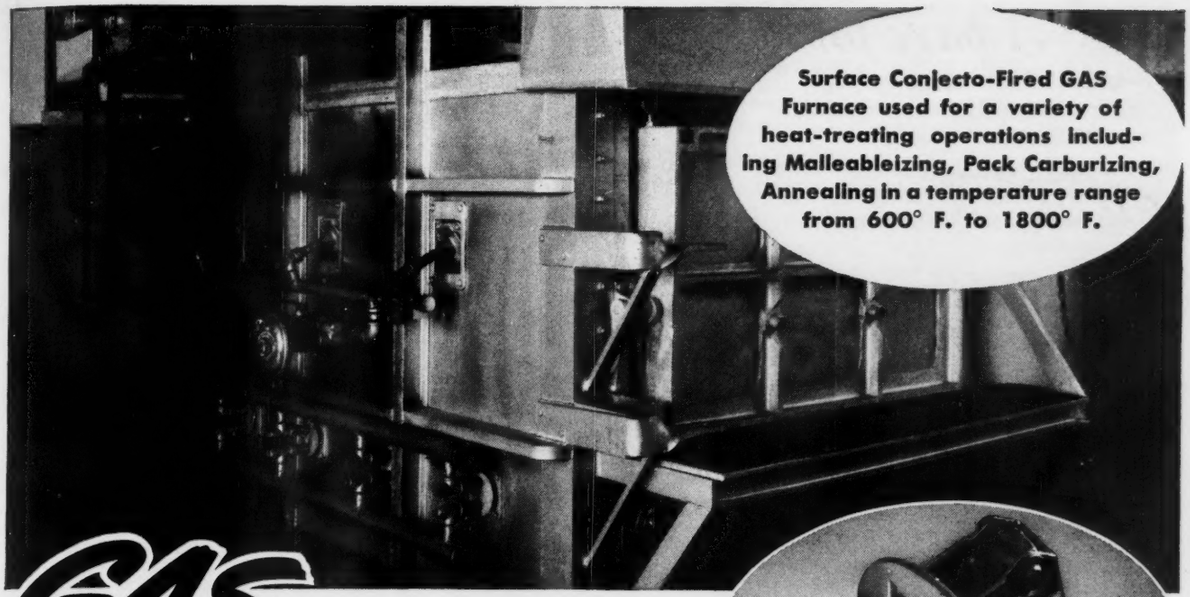
In Canada:

Carbide and Carbon Chemicals, Limited, Toronto

A page for **YOUR BEARING NOTEBOOK**

A FACT WORTH REMEMBERING! Yes, and we're saying it good and loud because it explains one of the basic reasons why 9 out of 10 bearing applications can be handled more efficiently with Timken tapered roller bearings.

As an engineer you'll run into many important problems involving bearing applications. If you'd like to learn more about this phase of engineering we'll be glad to help. Don't forget to clip this page for future reference—and, for additional information write today to The Timken Roller Bearing Company, Canton 6, Ohio.



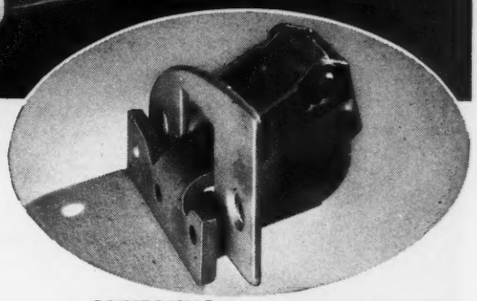
Surface Conjecto-Fired GAS Furnace used for a variety of heat-treating operations including Malleableizing, Pack Carburizing, Annealing in a temperature range from 600° F. to 1800° F.

GAS FURNACE PERFORMS MULTIPLE HEAT-TREATING FUNCTIONS UNDER VARIED CONDITIONS

In modern heat-treating, adaptability of equipment and flexibility of fuel are primary influences in any cost-per-piece analysis. As a typical example of the flexibility of the productive flames of GAS, this Conjecto-Fired GAS Furnace is used for a variety of operations without any change other than regulation of the fuel-mix and temperature controls.

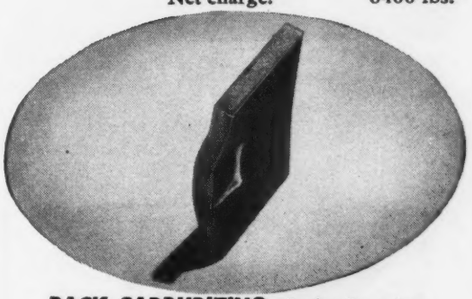
Atwood Vacuum Machine Company, Rockford, Illinois, is equipped to heat-treat pieces ranging from 1 ounce to 1000 pounds, in volume up to 15,000 pounds daily. Their modern Gas-fired Equipment is adapted for annealing, carburizing, drawing, hardening, normalizing, malleableizing, stress relieving, under rigid metallurgical specifications.

Experienced heat-treating specialists like Atwood Vacuum Machine Company use GAS because this flexible, controllable, rapid-heating fuel is so readily adaptable to all types of processing at any required temperature. The productive flames of GAS are so flexible that they can be used for any production-line heating operation, under the most exacting conditions.



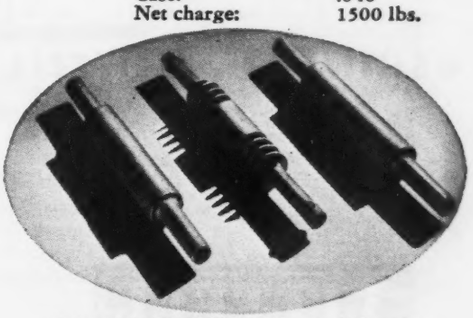
ANNEALING—Station wagon body hinge

Material:	SAE 1020
Temperature:	1600° F.
Time Cycle:	36 hours
Net charge:	6400 lbs.



PACK CARBURIZING—Brake Trunnions

Material:	Hot rolled SAE 1010
Temperature:	1650° F.
Time Cycle:	8 hours
Case:	.040
Net charge:	1500 lbs.



MALLEABLEIZING—Trailer Jack Screws

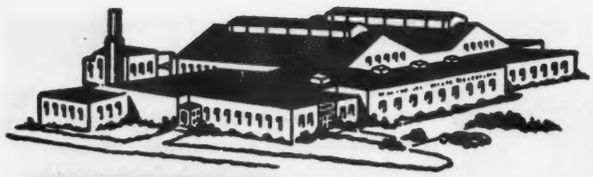
Material:	Malleable Iron
Temperature:	1750° F.
Time Cycle:	72 hours
Net charge:	10,000 lbs.

AMERICAN GAS ASSOCIATION

420 LEXINGTON AVENUE • NEW YORK 17, NEW YORK

Data and Photos by SURFACE COMBUSTION CORPORATION, Toledo, Ohio, Manufacturers of Gas Heat-Treating equipment

MORE AND MORE... THE TREND IS TO GAS FOR ALL INDUSTRIAL HEATING



Part of the Poultry Processing Line

Frozen Chickens in −5° Storage

Two of the Four Frick Compressors

Processing 24,000 Chickens Daily with

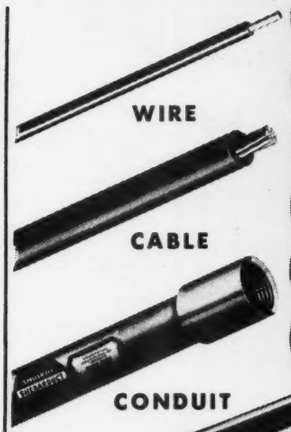
FRICK Refrigeration

They do it in the new plant of the Southern States Eastern Shore Marketing Cooperative, at Salisbury, Md. • Here 56,000 birds are kept on hand; the entire daily pack is cooled to 35°F, and half the chickens are quick-frozen at minus 35°. One of the storages is kept at 32°, the other at minus 5°; each holds 200,000 lb. of poultry. Up to 25 tons of ice are made per day, for precooling and shipping purposes. • Frick Refrigeration handles all the cooling work. If you want to be "in the know" on the latest quick-freezing methods, write for Frick Bulletin 147-B.

DEPENDABLE REFRIGERATION SINCE 1883

FRICK CO.

WAYNESBORO, PENNA. U.S.A.



WORLD'S LARGEST PRODUCER OF ELECTRICAL ROUGHING-IN MATERIALS

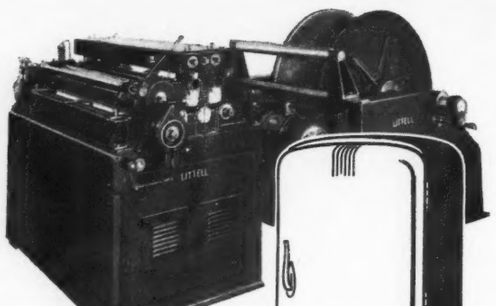
NATIONAL ELECTRIC PRODUCTS

WIRING SYSTEMS

WIRES AND CABLES

National Electric Products Corporation

Pittsburgh 30, Pa.



BEHIND IT...A *LITTELL FEED*

Refrigerators mean little but ice cubes, vegetables and cold cuts to the average user. Engineers, however, know the intricate production problems each unit involves. They know that "behind" the many sheet metal parts that contribute to the whole mechanism is a *Littell Feed* that dependably feeds and straightens the metal from which those parts are fashioned.

LITTELL

F. J. LITTELL MACHINE CO.

4127 RAVENSWOOD AVENUE • CHICAGO 13, ILLINOIS

automotive chassis design

(*Continued from page 248*)

standpoint of stability while traveling with either constant velocity or accelerated motion. To avoid the possibility of tipping, the center of gravity must be a minimum distance above the ground, and to insure ease of steering it should be as far toward the rear as possible. This last condition is modified by the requirement for smooth rapid acceleration of placing the center of gravity as far as possible ahead of the rear wheels. This increases the moment of inertia of the car about the rear axle and decreases the tendency the car has to rotate about the rear axle as the accelerating force is applied through friction with the road. In actual practice the location of the center of gravity is forward of center to permit smooth, rapid acceleration; control of the steering mechanism can be varied if necessary through a reduction gear.

Engine and drive mechanism vibration has not been considered, nor has the effect of tires on cushioning road shock, both of which affect comfort of ride but slightly with respect to the other factors. The analysis given here has been simple, and electrical systems incorporating mechanical analogies are used by automobile producers in a more complete analysis. But the principles illustrated are the fundamentals on which comfort of ride is based.

RCA Laboratories' "Chamber of Silence"—proving ground of tonal quality in radio and television instruments.

Ever hear SILENCE?

You walk into an eerie room. The door swings shut and you're wrapped in a silence so complete that it's an effort to listen. Sound in this vault-like cavern is reduced to the minimum of hearing.

But even *silence* has a sound of its own. Faintly you hear a subdued hiss; sometimes a soft hum. Scientists have suggested this may be the "noise" of molecules hitting the eardrums. Others wonder if it is caused by the coursing of the body's blood stream.

When acoustic scientists at RCA Laboratories want to study the actual voice of an instrument, they take it to this room. What they hear then is the instrument itself—and only the instrument. They get a true measure of performance.

Information gained here is part of such advances as: The "Golden Throat" tone system found only in RCA Victor radios and Victrola radio-phonographs . . . superb sound systems for television . . . the true-to-life quality of RCA Victor records . . . high-fidelity microphones, clear voices for motion pictures, public address systems, and interoffice communications.

Research at RCA Laboratories moves along many paths. Advanced scientific thinking is part of any product bearing the names RCA, or RCA Victor.

When in Radio City, New York, be sure to see the radio, television and electronic wonders at RCA Exhibition Hall, 36 West 49th Street. Free admission. *Radio Corp. of America, RCA Building, Radio City, N. Y. 20.*

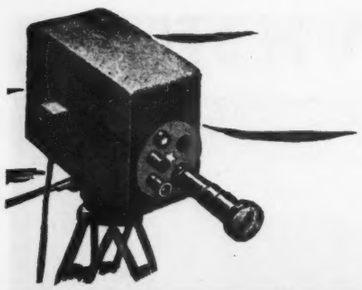
Continue your education with pay—at RCA

Graduate Electrical Engineers: RCA Victor—one of the world's foremost manufacturers of radio and electronic products—offers you opportunity to gain valuable, well-rounded training and experience at a good salary with opportunities for advancement. Here are only five of the many projects which offer unusual promise:

- Development and design of radio receivers (including broadcast, short wave and FM circuits, television, and phonograph combinations).
- Advanced development and design of AM and FM broadcast transmitters, R-F induction heating, mobile communications equipment, relay systems.
- Design of component parts such as coils, loudspeakers, capacitors.
- Development and design of new recording and reproducing methods.
- Design of receiving, power, cathode ray, gas and photo tubes.

Write today to National Recruiting Division, RCA Victor, Camden, New Jersey.
Also many opportunities for Mechanical and Chemical Engineers and Physicists.

RADIO CORPORATION of AMERICA



Plastics where plastics belong

Synthane where Synthane belongs

HERE's Synthane at work in a channel selector turret . . . the nerve-center of any television receiver.
Synthane is employed for a number of the intricate parts to insure extreme electrical and mechanical precision and rugged operation. It's an appropriate job for useful, hard-working Synthane . . . a timely example of plastics where plastics belong.

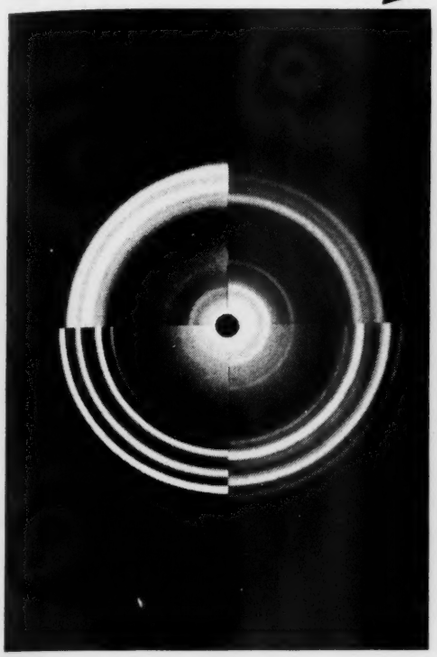
In addition, Synthane is moisture and corrosion resistant, hard, dense, easy to machine, and has unusual electrical insulating qualities. Synthane is also structurally strong, light in weight and stable over wide variations in temperature.

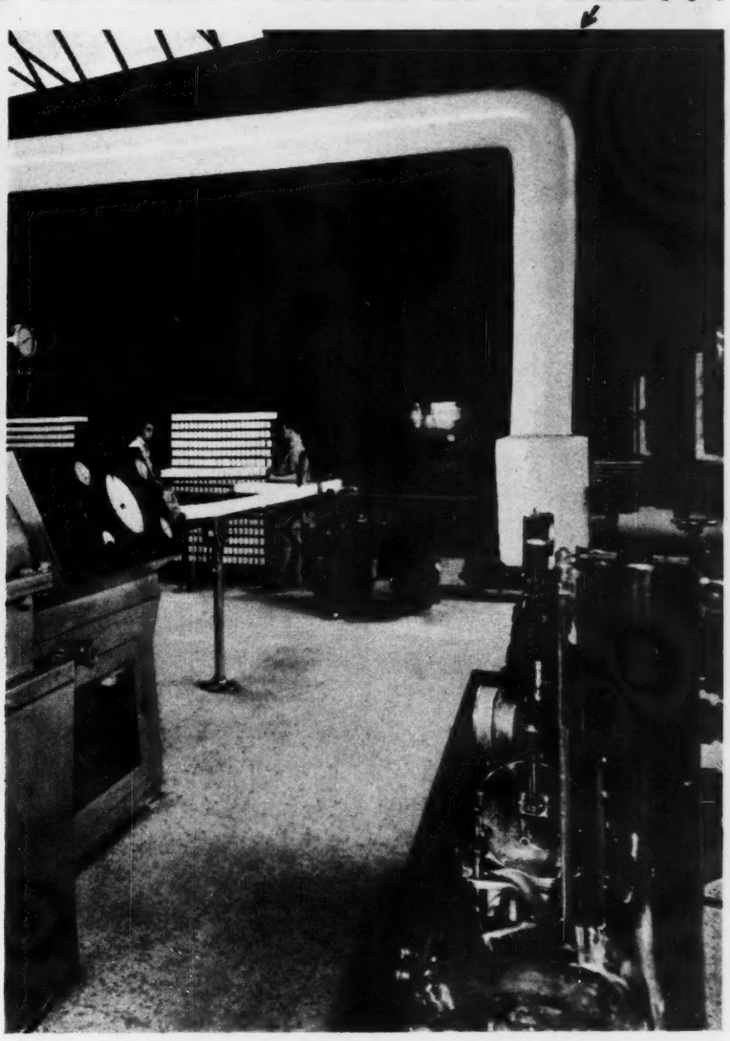
These and many other properties—combined—make Synthane adaptable to countless chemical, electrical and mechanical applications. Synthane Corporation, 14 River Road, Oaks, Pa.

SYNTHANE

SYNTHANE TECHNICAL PLASTICS • DESIGN • MATERIALS • FABRICATION • SHEETS • RODS • TUBES • FABRICATED PARTS • MOLDED-MACERATED • MOLDED-LAMINATED

PATTERNS in Soap set this Pattern in STEEL...





Chemists and Engineers Team-Up for Progress at P AND G

Here's an example of research that led to the engineering development of a new factory process.

The properties of a finished bar of soap depend on the polymorphic form or forms in which the soap molecules have crystallized. For instance, the comparison of the x-ray diffraction powder diagrams to the left illustrates that one soap can be prepared in at least four different polymorphic forms or phases. These different forms vary in physical properties such as plasticity, rate of solution in water, and ease of lathering.

Thus, to make a bar of soap with desirable properties, it is necessary to control both the phase composition and the chemical composition of the final product.

Research findings of this kind at Procter & Gamble are translated into designs for large-scale factory processes. The picture at the right shows a new type of factory process in which conditions are controlled to produce bars of soap of the desired crystalline form or phase.

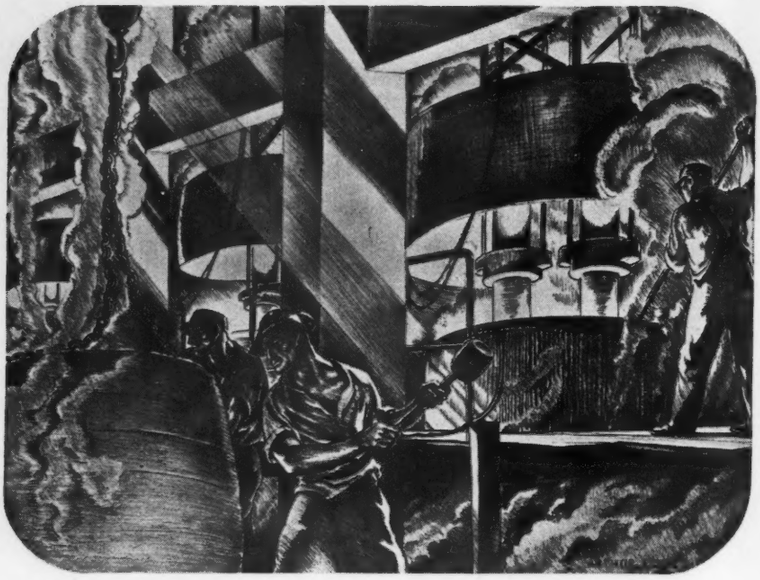
Design, development and construction of this mechanical equipment called for close cooperation between chemists and engineers—scientific teamwork that sets a pattern for progress.

PROCTER & GAMBLE

Cincinnati 17, Ohio

Producing ALUNDUM®

the world's most widely used abrasive



IN these unique, arc-type furnaces at the Norton electric furnace plant near Niagara Falls is produced ALUNDUM abrasive—fused at 3700° F. from the mineral, bauxite.

Introduced to industry by Norton in 1901 this first electric-furnace-made aluminum oxide abrasive revolutionized the grinding of steels because of its combination of hardness, sharpness and toughness.

Subsequent Norton developments were designated as 38 ALUNDUM and 57 ALUNDUM—and then in 1946 came the sensational 32 ALUNDUM abrasive.

Today ALUNDUM abrasive in its various forms is the world's most widely used abrasive.

NORTON COMPANY • WORCESTER 6, MASS.

(BEHR-MANNING, TROY, N. Y. IS A NORTON DIVISION)

NORTON

ABRASIVES — GRINDING WHEELS — GRINDING AND LAPPING MACHINES
REFRACTORIES — POROUS MEDIUMS — NON-SLIP FLOORS — NORBIDE PRODUCTS
LABELING MACHINES (BEHR-MANNING DIVISION) COATED ABRASIVES AND SHARPENING STONES

cars for tomorrow

(Continued from page 238)

paper and putting it into production are two entirely different things. It is to be suspected that the great majority of the "Buck Rogers" school of designers were little concerned with the cost involved in their fantastic creations. A design is worthless if it cannot be translated into an actual automobile that is structurally sound, economically feasible, and functionally beautiful. We should not expect these "Buck Rogers" designs for some time for two major reasons. First, past experience has taught automobile manufacturers only too well that the public, while it may be interested in fantastic designs, is unwilling to buy anything which departs too radically or too suddenly from accepted standards and practices. Again — evolution, yes; revolution, no. Second, the post-war dream car failed to make its appearance because it is economically impossible to manufacture it.

The actual car of the future, as has already been stated, will become increasingly functional as well as beautiful. In general, safety, comfort, practicability of maintenance, and performance will be stressed in future design. The automobile stylist will find himself working in much closer relationship with the experimental engineer than he has in the past. The stylist will rely more heavily upon tests and research. The work of one will dovetail more intimately with the work of the other. Engineers on the other hand will begin to look upon stylists as real contributors to automotive progress rather than as ivory-tower inhabitants dabbling freakishly with a drawing pencil and airbrush.

One influence which will definitely become more noticeable in future automobiles is that of aircraft design. The automobile, like the plane, moves through air; this movement through air is greatly affected by its design and contours. In purring along at fifty, sixty or even higher speeds, surface smoothness and streamline contours mean safer and more comfortable rides. Highly important too has been the elimination of wind noises through streamlining — a factor which in the past has contributed measurably to drivers' nervousness and fatigue. More and more attention will be directed toward eliminating those elements which offer wind

(Continued on page 266)

ENGINEERS, like Ralph Hovey, R. P. I. '37 and William Godfrey, Rutgers '44, use supersonic device to test a metal's thickness.

LABORATORY EXPERTS, like Gloria Higgins, make many scientific tests to assure *quality* petroleum products for your use.

CAT CRACKER TESTERS, like A. J. Ely, Lehigh '47 and K. O. Johnson, Minnesota '42, run one of many checking tests at a giant catalytic cracking plant.

THEY'RE what count most with us!

PERHAPS THE MOST important thing behind the Esso Sign is not just the great laboratories and refineries of Esso Standard Oil Company...

No...it's probably just *the people and the kind of jobs they have!*

Workers who have not had an important strike or labor disturbance in over 30 years!...Workers who today average over 14 years with the company!...

Workers with regular, paid vacations each year. Workers with high wage scales and steady work. Workers with retirement on pensions for life. Workers with an opportunity for advancement... because they know there's company training to help them get ahead... because they know *every president of our company has worked his way up!*

Such is the policy of employee benefits at Esso Standard Oil Company... a policy that believes *good jobs draw and hold good workers*...a policy that believes *good people are good business!*

REFINERY WORKERS, like Bill Kohl, help make "Happy Motoring" come true at the famous Esso Sign.

ESSO STANDARD OIL COMPANY

The man who cooled a million hotheads

Some women can fix anything with a bent hairpin. But it took a man to solve a problem that had stumped the hairpin experts for generations.

He solved the irritating problem of opening and shutting stubborn windows without benefit of crowbars, by means of an ingenious, automatic sash-balance, which enables you to perform that operation with one finger.

The principal member of this new temper-saver is a length of high carbon, sash-balance spring steel made by Roebling. The manufacturers have such confidence in this Roebling product that they guarantee their sash balance for the entire life of the building in which it is installed.

Roebling flat spring steel is one of the most widely used of the hundreds of Roebling products, yet it is the least known. Few men think of umbrella stays, clock springs, feeler gauges, measuring rules and tapes, and thousands of other articles, in terms of flat spring steel.

On the other hand, when enterprising inventors create knotty design problems, when competition dictates re-design of a product in order to lower costs, engineers invariably look to these Roebling products for at least part of the solution.

Born of free enterprise . . . the system that creates demands for thousands of articles that are unknown to the citizens of other countries . . . flat wire and flat spring steel point the way to other undreamt of developments and markets.

Roebling flat wire and spring steel have earned the confidence of designers and engineers throughout industry . . . the world over.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities

A CENTURY OF CONFIDENCE **ROEBLING**

The Miracle

you put on your eggs...

Just plain Salt! But what wonders it performs in the hands of expert chemists and engineers. Its two components play a big part in the production of paper, soap, glue, metals, metal products, textiles, insecticides. They help to sanitize water, launder clothing, kill bacteria in dairies, restaurants, food plants.

"Miracle-working" with Salt—as well as other basic chemicals—has been Pennsalt's business for 98 years. Starting with a modest plant at Natrona, Pa., Pennsalt has steadily grown, until today it stands as one of America's important chemical companies.

Big? Yes . . . but not so big as to swallow up its promising young men. Old? Yes . . . but not too old to adopt young ideas that are sound. Pennsalt was founded by a young man; and grew large through the efforts of young men.

The future, too, looks bright for Pennsalt . . . and for the young men who are going to build it. Pennsylvania Salt Manufacturing Company, Philadelphia 7, Pa.

PENN SALT

CHEMICALS

TWO SUCCESS STORIES with the same reason
Just as the leather football helmet is a continuing success on today's gridiron, leather power-transmission belting is a continuing success in today's industry.
The reason: Both take advantage of the natural characteristics of leather.
Leather is a live, dynamic, resilient material. It has shock-absorbing ability, great strength and long life. That's why leather belting is an efficient, modern drive.
NEWS NOTE
The National Football League's governing body recently barred the use of plastic helmets in league play because of the increased possibilities of serious injury from contact with the hard surface of the headgear. This means that leather helmets will continue to be the standard head protection for American football teams.
AL-12
American LEATHER BELTING Association
Headquarters for Authentic Power Transmission Data
41 PARK ROW, NEW YORK 7, NEW YORK

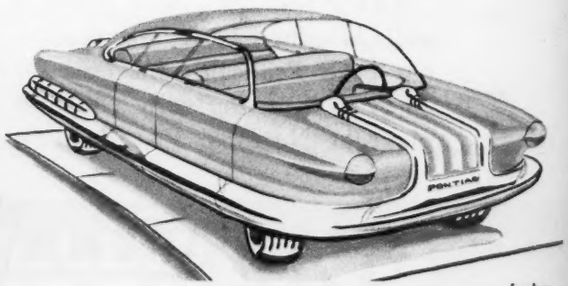
HIGGINS
AMERICAN WATERPROOF INDIA INK
Now available with
Cork and Curved Quill Stopper
OR
Perfected Rubber Dropper Stopper
Both type stoppers available on waterproof black.
When ordering from your dealer, specify the type stopper required.
with perfected dropper stopper
HIGGINS
AMERICAN INDIA INK
waterproof black
HIGGINS INK CO., INC.
271 NINTH STREET, BROOKLYN 15, N. Y.

cars for tomorrow

(*Continued from page 262*)

resistance and interfere with the forward motion of the car. This does not imply merely the removal of a gadget here and a gadget there but a genuine streamlining in which hitherto protruding units will be either eliminated outright or absorbed into the general contours on the vehicle. The harshness of straight lines will be further eliminated. A functional, clean appearance — that will be the over-all affect of the aircraft influence.

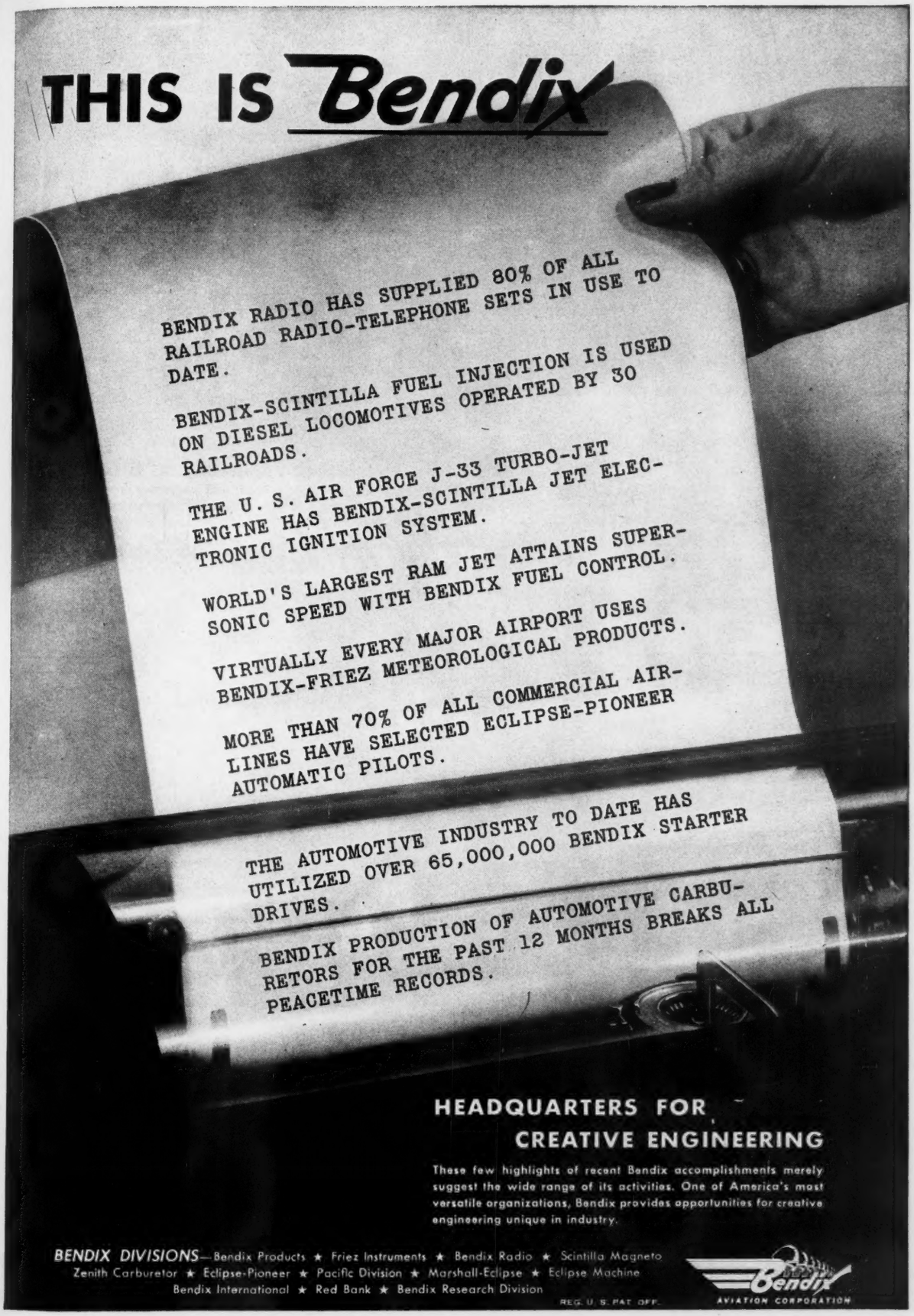
Experimentation in positioning the engine in the rear rather than the front promises to influence design — but to a smaller degree than was once anticipated. Up to now, engine weight has made it inadvisable to locate the power plant in the rear because of the serious distortion of weight distribution which would be produced. But the industry is now designing engines which weigh far less than those used in the past and without



Jordan

(*Continued on page 272*)

THIS IS Bendix


BENDIX RADIO HAS SUPPLIED 80% OF ALL RAILROAD RADIO-TELEPHONE SETS IN USE TO DATE.
BENDIX-SCINTILLA FUEL INJECTION IS USED ON DIESEL LOCOMOTIVES OPERATED BY 30 RAILROADS.
THE U. S. AIR FORCE J-33 TURBO-JET ENGINE HAS BENDIX-SCINTILLA JET ELEC-TRONIC IGNITION SYSTEM.
WORLD'S LARGEST RAM JET ATTAINS SUPER-SONIC SPEED WITH BENDIX FUEL CONTROL.
VIRTUALLY EVERY MAJOR AIRPORT USES BENDIX-FRIEZ METEOROLOGICAL PRODUCTS.
MORE THAN 70% OF ALL COMMERCIAL AIR-LINES HAVE SELECTED ECLIPSE-PIONEER AUTOMATIC PILOTS.
THE AUTOMOTIVE INDUSTRY TO DATE HAS UTILIZED OVER 65,000,000 BENDIX STARTER DRIVES.
BENDIX PRODUCTION OF AUTOMOTIVE CARBU-RETORS FOR THE PAST 12 MONTHS BREAKS ALL PEACETIME RECORDS.

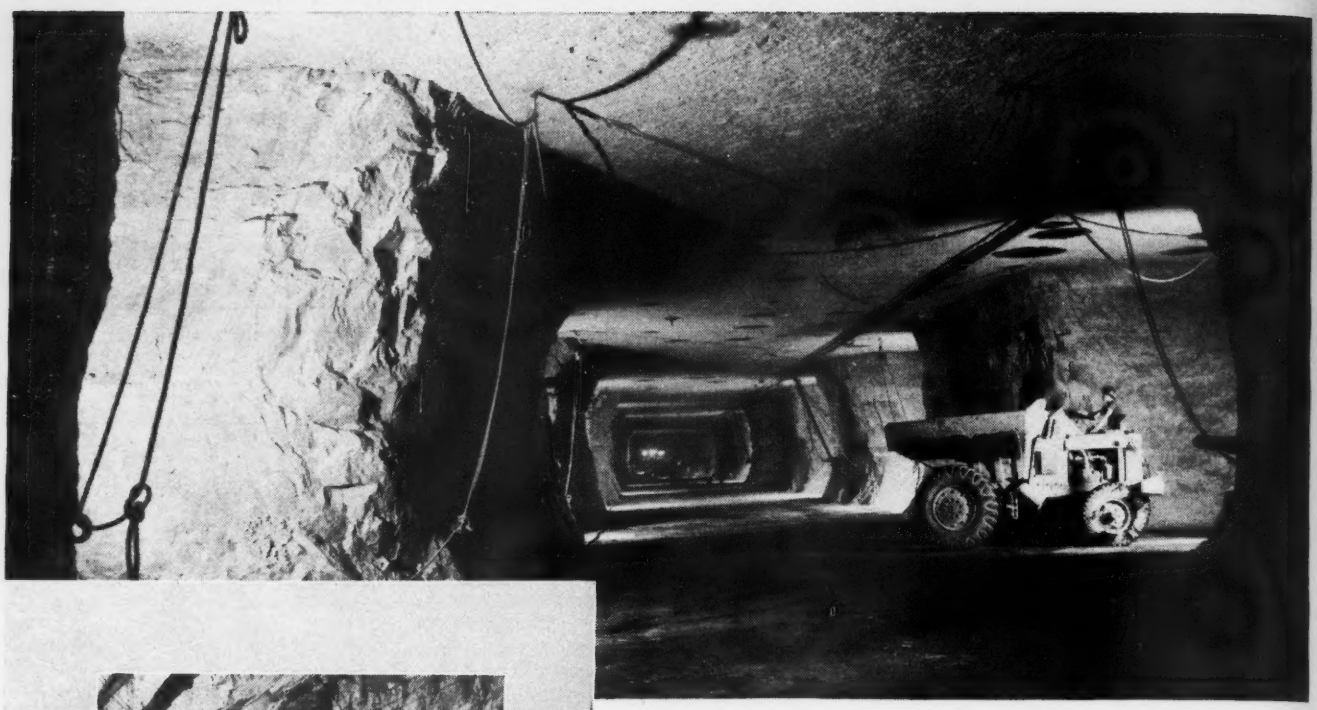
HEADQUARTERS FOR CREATIVE ENGINEERING

These few highlights of recent Bendix accomplishments merely suggest the wide range of its activities. One of America's most versatile organizations, Bendix provides opportunities for creative engineering unique in industry.

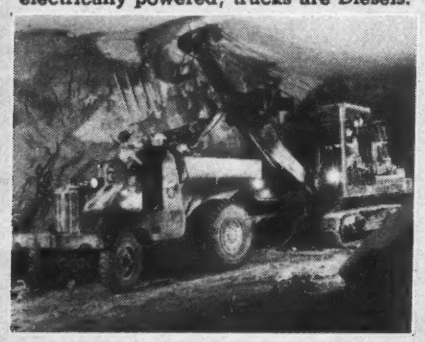
BENDIX DIVISIONS—Bendix Products ★ Friez Instruments ★ Bendix Radio ★ Scintilla Magneto
Zenith Carburetor ★ Eclipse-Pioneer ★ Pacific Division ★ Marshall-Eclipse ★ Eclipse Machine
Bendix International ★ Red Bank ★ Bendix Research Division

REG. U. S. PAT. OFF.

Bendix AVIATION CORPORATION



Photographs show vast size of limestone mine operation. Shovels are 1½ yard, electrically powered; trucks are Diesels.



World's deepest LIMESTONE MINE

TO AUGMENT raw materials supplies, Columbia mined 2,200 feet for limestone—almost beneath its plant at Barberton, Ohio.

The operation is notable in a number of other ways. Modern equipment of great size—capable of moving 300 tons of stone per hour—was assembled underground. The stone is screened and crushed; then brought to the surface by a semi-automatic hoist which attains a speed of 2,000 feet per minute and automatically brakes and dumps at the top.

This is another of numerous developments pioneered by Columbia for improved production and service to industry . . . Pittsburgh Plate Glass Company, Columbia Chemical Division, Pittsburgh 13, Pa. Manufacturers of Soda Ash, Caustic Soda, Liquid Chlorine, Sodium Bicarbonate and other alkalies and related essential industrial chemicals.

COLUMBIA CHEMICALS

CHICAGO · NEW YORK · BOSTON · CINCINNATI · MINNEAPOLIS · CHARLOTTE · ST. LOUIS · CLEVELAND · PITTSBURGH · PHILADELPHIA · SAN FRANCISCO

PPG PAINT · GLASS · CHEMICALS · BRUSHES · PLASTICS

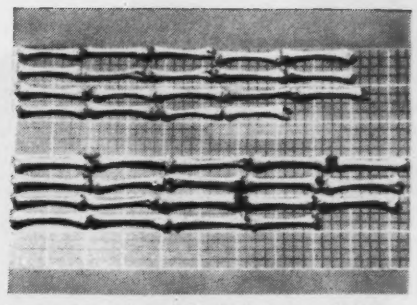
PITTSBURGH PLATE GLASS COMPANY

DU PONT Digest
For Students of Science and Engineering

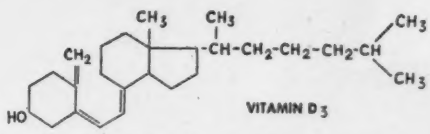
Experimental research results in better Vitamin D source for poultry industry

Fifteen years of work by Du Pont chemists, biochemists, physicists, and engineers behind development of "DELSTEROL"

In 1922, it was shown that vitamin D controls the utilization of calcium and phosphorus in the body, especially in the bones of growing animals. This led to the discovery that leg weakness in chicks, poor production, low hatchability of eggs, and other disturbances were caused by a deficiency of this vitamin.

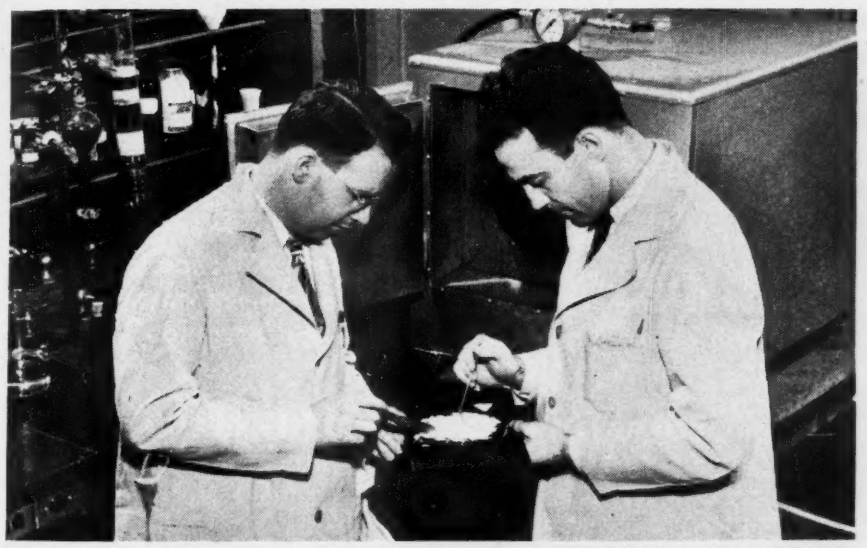


Bones at top, from birds fed no vitamin D, are shorter, poorly developed, and fragile, compared with bones at bottom from birds fed Du Pont "Delsterol."



Du Pont chemists and engineers carried this forward by devising a successful commercial process for making 7-dehydrocholesterol and irradiating it to vitamin D_3. Several forms of vitamin D are now manufactured by Du Pont, ranging from oil and dry powder concentrates—used by the poultry trade under the trademark "Delsterol"—to vitamin D_3 crystals of the highest purity.

Today's chickens are healthier, and the average annual egg yield over the last eight years has increased from 134 to 159 per bird. To a considerable degree, this is a result of the fifteen years of research devoted by Du Pont scientists to the development of "Delsterol" "D"-activated animal sterol.



L. Fullhart, Ph.D. 1946 in organic chemistry, Iowa State College and W. F. Marlow, chemist, B.S. 1941, George Washington University, preparing to examine a sterol product for quality and yield.

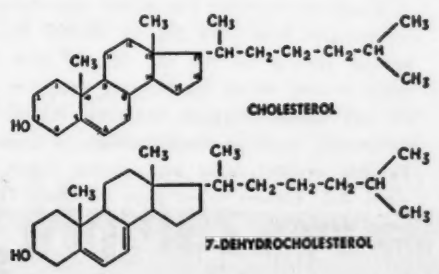
Scientists subsequently discovered that vitamin D could be made by irradiating plant or animal tissues with ultraviolet light. This reaction has since been shown to consist of transforming certain provitamins from the group known as sterols, into vitamin D. The final result of these discoveries was the present large-scale commercial production of the vitamin by a series of complex chemical and photo-chemical reactions which require careful control by chemists, biochemists, physicists, and engineers. In this development, Du Pont scientists played an important part.

Ergosterol once the only source

For years before 1934 it was assumed that ergosterol, a sterol first isolated from vegetable sources, was the only provitamin that yielded vitamin D. In that year, Du Pont research men—who had been studying the chemistry and biochemistry of vitamin D for almost four years—announced that the provitamin in animal cholesterol was *not* ergosterol. They showed that the activated provitamin in cholesterol gave a vitamin D much more effective for chicks than that of irradiated ergosterol. This fact was based on many comparative assays of irradiated cholesterol, irradiated ergosterol, and irradiated mixtures of these substances on rats and chicks.

Synthesis from Cholesterol developed

Other investigators showed that the provitamin in cholesterol was 7-dehydrocholesterol by developing its synthesis from cholesterol. The relationship between cholesterol, 7-dehydrocholesterol, and vitamin D_3 is shown by the following formulas:



Questions College Men ask about working with Du Pont

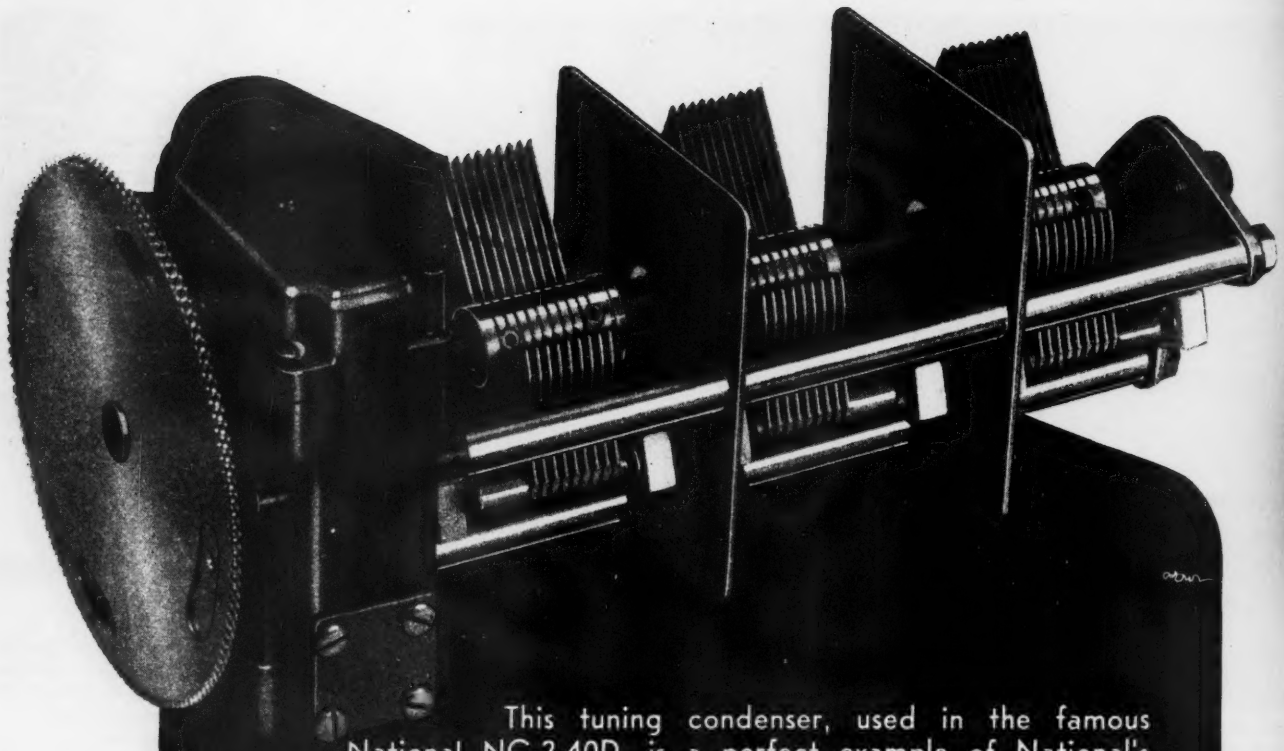
What are the opportunities in sales?

Separate sales staffs are maintained by each of Du Pont's ten manufacturing departments. Training in chemistry or chemical engineering is a prerequisite for some sales positions, which may be in one of three fields: technical sales, sales development, or direct selling. New employees usually acquire technical background by first working in a control laboratory or in production. Write for booklet, "The Du Pont Company and the College Graduate," 2518 Nemours Building, Wilmington 98, Delaware.

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

More facts about Du Pont — Listen to "Cavalcade of America," Mondays, 8 P.M., EST on NBC

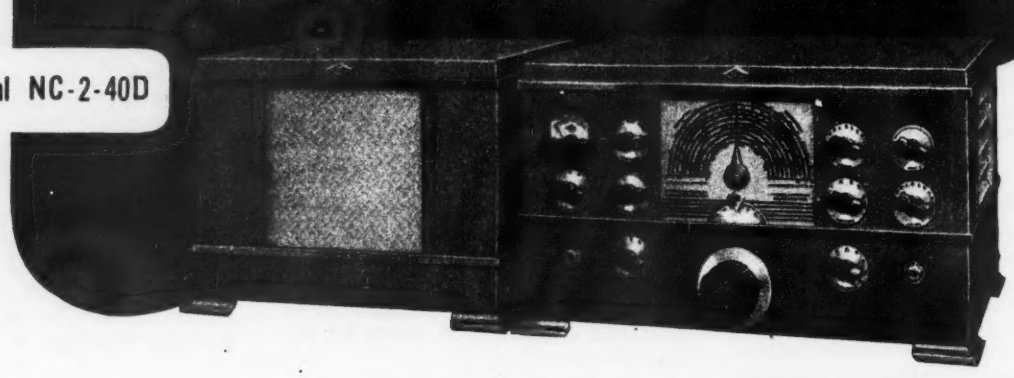


This tuning condenser, used in the famous National NC-2-40D, is a perfect example of National's flawless construction and design. Engineered and manufactured in National's own plant, it is of extremely rigid construction, preventing unwanted frequency modulation due to vibration. Three bearings on the rotor shaft assure permanent alignment. The drive is through a large preloaded gear. No strings to deteriorate, no backlash! Each rotor is individually insulated and has its own contact. Stator insulation is low-loss steatite.

With precise, rugged components like this, no wonder National communication receivers lead the field — in any climate, under all operating conditions! National precision components are available at your dealer's.

NATIONAL COMPANY INC., MALDEN, MASS.

The National NC-2-40D



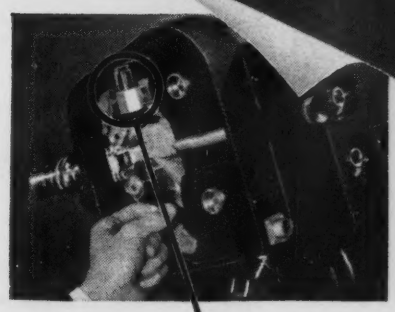
A superb receiver for either commercial or amateur use covering frequencies from 490 kcs. to 30,000 kcs. Calibrated electrical bandspread tuning on the 80, 40, 20 and 10-meter bands. A 40 to 1 main tuning drive mechanism provides exceptional tuning accuracy on all bands. Design features include temperature compensation, automatic voltage stabilization, a series valve noise limiter, new flexible crystal filter and phono input. Operates from 115 or 230 volts AC. Eleven tubes plus rectifier. Try it — compare it — today at your dealer's!

$225.00 *(speaker extra)*

National
© EST. 1914
NATIONAL COMPANY, Inc.
MALDEN, MASSACHUSETTS

Kodak

Argon "timer" on Kodak High Speed Camera puts edge marks on film, as shown below, for externally fed rectangular pulses.



Splitting a second of action into 3000 measured parts

The Kodak High Speed Camera . . . a precision instrument that gives you exact visual answers to complex industrial time-motion problems.

WHEN high speed machinery doesn't work as it should or wears out too soon . . . when you need to know how fast-moving liquids behave . . . when any complex time-motion problem confronts you . . . try motion analysis with the Kodak High Speed Camera.

By taking pictures up to 3000 frames a second and showing them at regular speeds . . . you visually slow down action almost 200 times! And flash marks which the camera puts along the film edge time any phase of action in fractions of milliseconds.

By using this precision instrument in your laboratory or plant, you can track down and measure almost any problem in flexure, inertia, waste-motion . . . analyze chemical and electrical phenomena for permanent record . . . for study . . . for group discussion.

Send the coupon for a copy of the booklet "Magnifying Time." It will tell you how this instrument is being used advantageously in many industries.

EASTMAN KODAK COMPANY
Industrial Photographic Division, Rochester 4, N. Y.

High-Speed Movies

. . . another important function of photography

Milling cutter bit caught in the act of breaking. Edge marks on film give the exact relative time and speed of any phase of high speed action.

"Kodak" is a trade-mark

Mail this coupon for new FREE booklet

Eastman Kodak Company
Rochester 4, N. Y.

Please send me ☐ your new, free booklet on the Kodak High Speed Camera; ☐ your 16mm. demonstration reel of examples of high speed movies.

Name_____
(please print)

Company_____ Dept._____

Street_____

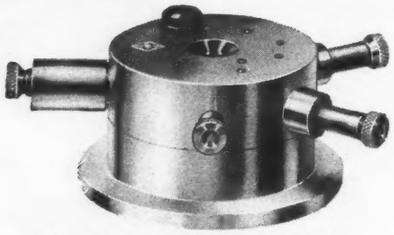
City_____ State_____

partners in creating

K & E drafting instruments, equipment and materials have been partners of leading engineers for 80 years in shaping the modern world. So extensively are these products used by successful men, it is self-evident that K & E has played a part in the completion of nearly every American engineering project of any magnitude.

KEUFFEL & ESSER CO.
EST. 1867
NEW YORK • HOBOKEN, N. J.
Chicago • St. Louis • Detroit
San Francisco • Los Angeles • Montreal

FOR RESEARCH IN RADIOACTIVITY



3¼" x 2⅜" x 1⅜"; Weight 3½ oz.

Lindemann Electrometer

This instrument was originally designed for use in connection with photo-electric measurements of light in astronomical work. It is now used extensively for the determination of radioactive emission. Compact and stable, it has high sensitivity, stable zero, and does not require levelling. The capacitance of the instrument is less than 2 cm. For general use, the instrument is placed upon a microscope stand and the upper end of the needle observed, illumination being obtained in the usual way through a window in the electrometer case.

Write for descriptive literature

CAMBRIDGE INSTRUMENT CO., INC.
Pioneer Manufacturers of Precision Instruments
3756 Grand Central Terminal, New York 17

pH Meters and Recorders, Galvanometers, Gas Analyzers, Fluxmeters, Exhaust Gas Testers, Surface Pyrometers, and other Electrical and Mechanical Instruments for Use in Science, Industry and Medicine

cars for tomorrow

(*Continued from page 266*)

sacrifice of efficiency and economy. Lighter engines will give the designer much greater freedom in shifting engine location, for a lightweight engine can theoretically, at least, be placed almost anywhere the designer wishes. In view of this, it is quite evident that exterior styling need not necessarily be influenced greatly by rear engine location unless the stylist wishes to dramatize such a feature.

The era draws to an end for fancy chrome grills which have advanced from honeycomb patterns to the current "fins, bar and egg crates." Abstraction of the radiator shape on the nose to retain individual identity can be expected. Radiator ornaments will be discarded in favor of naked, sloping hoods.

Plastic bodies with clear plastic tops cannot be foreseen before the far future. In the meantime, much development and testing must take place. There is, however, a definitely increasing trend toward better vision — an important factor in safety. Larger window area and shorter, sloping hoods will greatly increase vision for the driver and all the passengers. The use of curved glass makes it possible to move the front door corner post back to increase the driver's angle of vision. Wider and deeper hoods will make the repairman's job much easier.

Cadillac and Oldsmobile have hit on a coming trend in dashboard design with the instruments grouped in clear unobstructed view of the driver.

A more complete use of the unit frame body construction will increase safety, comfort, and lighten the body.

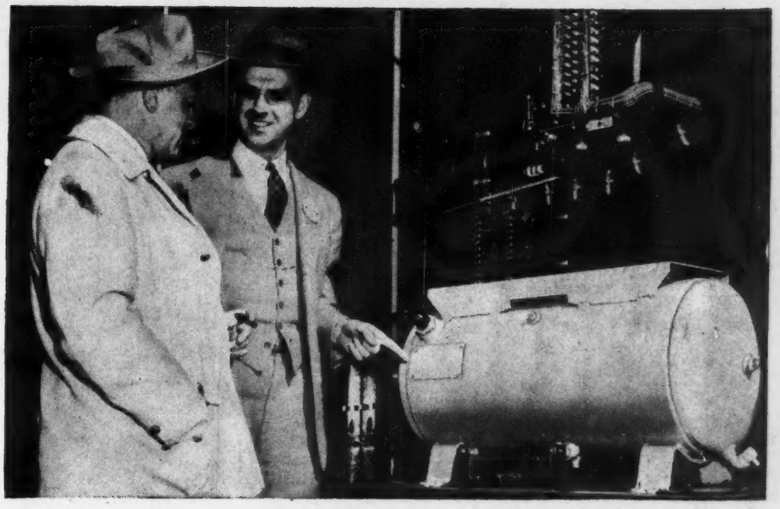
Eventual replacement of the rear seat with moveable lounge chairs and the increased use of small, low-pressure tires will add greatly to passengers' riding comfort.

The protruding pontoon sides of post-war cars will continue for some time but will soon be protected by a three-dimensional chrome molding, a fluted stainless steel lower skirt, or laminated rubber on the lower edge of the panel side.

Cars will continue to become lower but head room will definitely increase.

The automobile of the future, though it may appear different than it does today,will look like a means of transportation, not an artist's nightmare. Its changes will be governed by scientific laws and research, by testing and experimentation. It will personify the spirit of transportation as that spirit soars to new conceptions of beauty and reaches out for new functional attractiveness. But it will be — must be — based on engineering, for beauty alone is not enough. This does not in any sense imply that the handsome motor car as we know it today must give way to something unsightly. On the contrary, the beauty of tomorrow's automobile will be enhanced by the planning which has gone into its entire construction.

There's a future for you in *Sales* at Westinghouse



In the electrical manufacturing industry, it takes an *engineer* to sell. He must be prepared not only to explain the features, construction and design of his product, but must be able to apply it as well. He should foresee operating problems of his customer and be able to explain how the apparatus works *under every condition.*

For example, at Westinghouse:

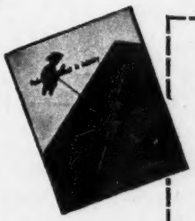
APPARATUS SALESMEN... are responsible for the sales of all Westinghouse products to a group of regular customers.

PRODUCT SPECIALISTS . . . are experts on specific types of equipment; they know and can demonstrate how the motor, switchgear or other apparatus works.

DIVISION SALES ENGINEERS . . . are specialists covering broad lines of products such as steam equipment, radio apparatus and are experts in its application.

INDUSTRY SALESMEN . . . keep abreast of changing developments in specific industries, such as textile, steel, petroleum . . . and formulate plans to maintain the advance position of Westinghouse in these fields. Your sales opportunities with Westinghouse are as broad as industry itself. Wherever power is applied, there's need for Westinghouse equipment. G-10004

This is but *one* of the many opportunities open in the electrical field. There are many others—in engineering, research and manufacturing at Westinghouse. Begin plans for your future by sending today for your free copy of "Finding Your Place in Industry".



Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

To obtain copy of "Finding Your Place in Industry", consult Placement Officer of your university, or mail this coupon to:

The District Educational Coordinator
Westinghouse Electric Corporation
10 High Street
Boston 10, Massachusetts

Name_____

College_____ Course_____

Address_____

City_____ State_____ C-3

. . . a great name in research with a big future in **CHEMISTRY**

PLASTICS—INFANT INDUSTRY THAT GREW UP FAST

Ten years ago the infant plastics industry was teething. It has since rushed through a precocious childhood and grown to a vigorous and impressive maturity. Today the plastics industry is a multimillion-dollar business. Two-thirds of all American factories use plastics materials in their manufacturing operations.

Of course, plastics were not new ten years ago. In fact, back in 1894 General Electric was making lamp carbons out of an early plastic—lampblack-impregnated potter's clay.

New Materials Encourage Growth

But the rapid growth of the plastics industry came in the late 1930's when new materials and improved molding techniques encouraged its expansion. Then, with World War II, plastics manufacturing accelerated tremendously.

Synchrotron ring, molded by G. E. for Univ. of California's new betatron atom-smasher.

General Electric's position in the plastics field is unique in that G. E. is the world's largest manufacturer of finished plastics products and also a manufacturer of molding powders.

General Electric offers a complete plastics service. It has facilities for developing special compounds and for designing, engineering, and molding plastics products to meet individual customers' requirements.

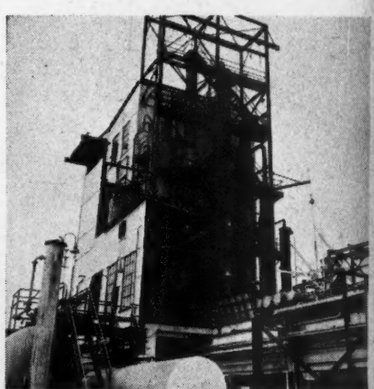
The variety of parts and products turned out by General Electric's Plastics Division is startling—and it illustrates the diversity of applications that are being found for plastics in the postwar world.

For Rowboats and Radios

Take, for example, the plastics dinghy. This is a four-passenger boat molded of laminated plastics by General Electric for a New England boat manufacturer. Then there is the synchrotron ring for the University of California's new betatron atom-smasher. It's the largest single part ever molded by G. E. Less spectacular, perhaps, but still important, are the hundreds of more familiar plastics products like clock cases, compacts, radio cabinets, camera cases, packages of all sorts, Textolite surfacing material, plastics parts for automobiles, refrigerators, and other appliances—even plastics cups for milking machines.

This plastics dinghy was molded by General Electric for the Beetle Boat Company.

Since 1920, General Electric has manufactured molding powders for its own use. Recently, a synthetic phenol plant was completed in Pittsfield. As a result of this increased production capacity, G. E. can now provide high quality phenolic compounds to other molders.



New G-E Phenol plant at Pittsfield, Mass., showing fractionating towers on distillation building.

General Electric's plastics activities are just one phase of the operations of the Chemical Department, where research is opening new doors to progress. In the fascinating new field of silicone chemistry, in resins, in insulating varnishes, in permanent magnets, General Electric is making contributions to chemical knowledge. For more information on any of these activities, write *Chemical Department, General Electric Company, Pittsfield, Massachusetts.*

A message to students of chemistry from

DR. J. J. PYLE

Director, General Electric Plastics Laboratory

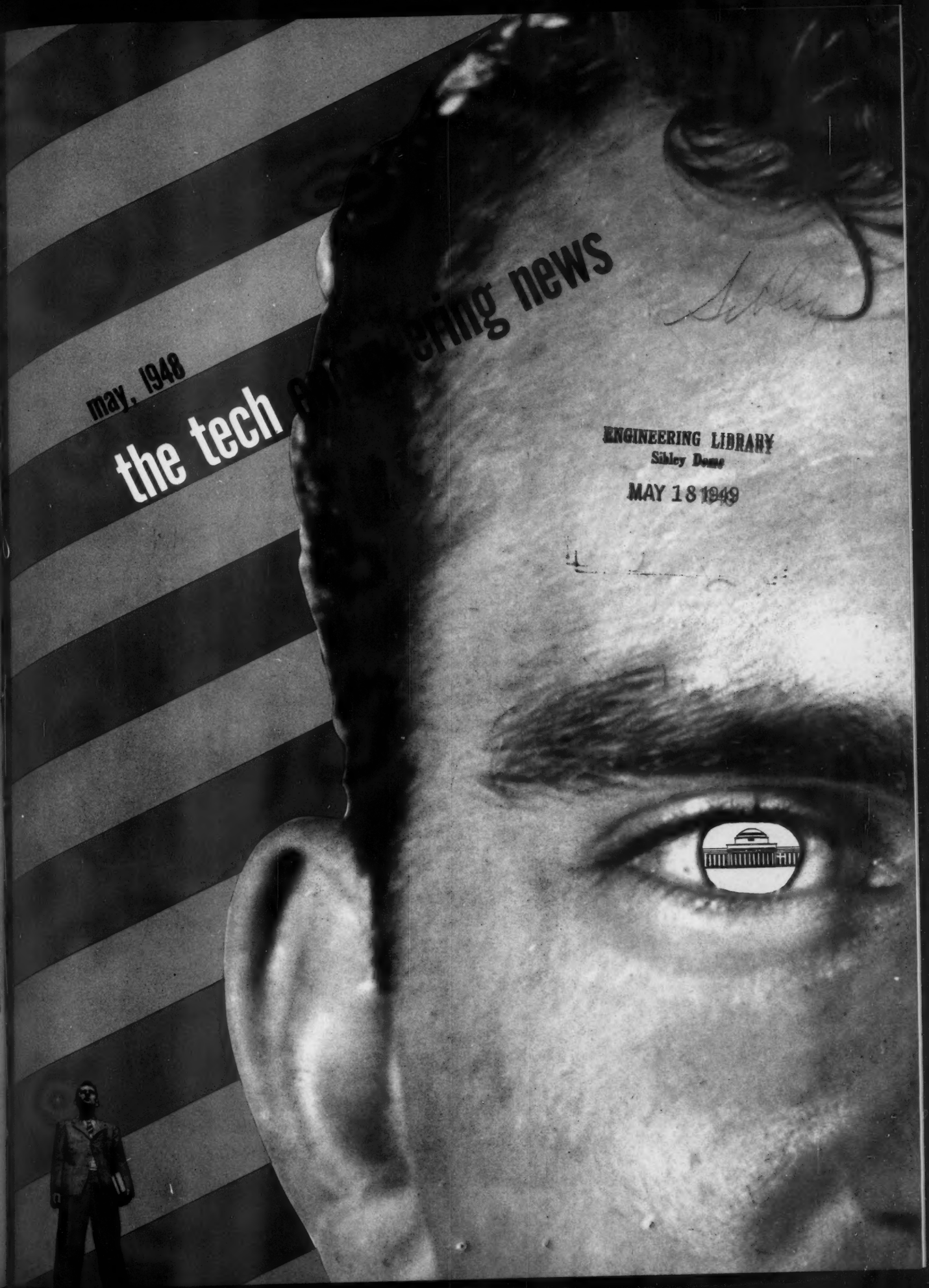
The field of plastics is surely a stimulating one—and one that offers many opportunities and the utmost in challenge to graduate chemists and chemical engineers. At General Electric, plastics research is presenting new possibilities in this fascinating field that should prove exceptionally interesting to young technical men.

CORNELL UNIVERSITY APR 21 1948 LIBRARY

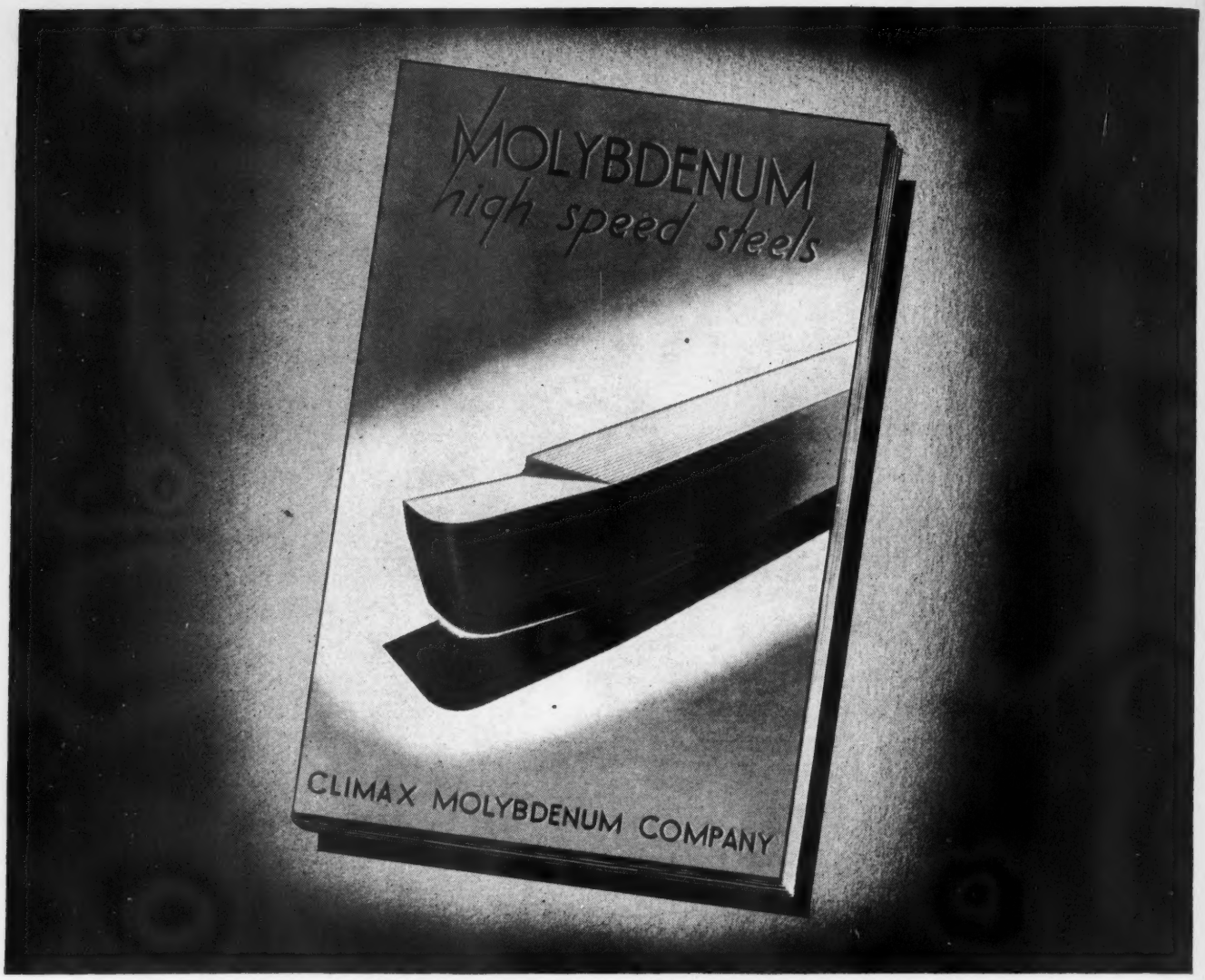
GENERAL ELECTRIC

CD48-B1

PLASTICS • SILICONES • INSULATING MATERIALS • GLYPTAL ALKYD RESINS • PERMANENT MAGNETS



ENGINEERING LIBRARY
Sibley Dome
MAY 18 1948



FREE TO ENGINEERS!

Want to know more about high speed steels?

Here is a booklet that can add to your store of information. It is packed full of facts about molybdenum high speed steels. It gives the history of these steels, applications, economic advantages, and figures on actual cutting performance.

You'll also find information on the forging, annealing, and heat treatment of these modern steels.

This booklet is not a textbook, but a brief resume of molybdenum high speed steels which we believe you will find useful. For a free copy of this informative booklet, write today.

MOLYBDIC OXIDE—BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"
CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

Climax Molybdenum Company
500 Fifth Avenue New York City

MOLY

Another page for **YOUR BEARING NOTEBOOK**

How to make a machine tool cut out the chatter

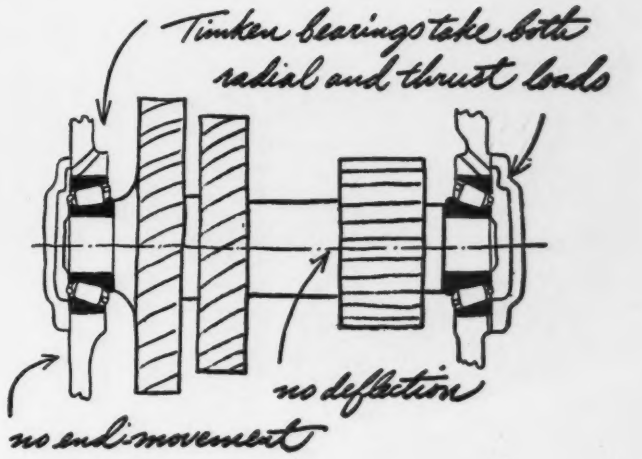
Engineers who design machine tools know that if they eliminate "chatter"—or vibration—they will be paving the way for faster, more precise machining. That's why you'll find the great majority of machine tools equipped with Timken tapered roller bearings.

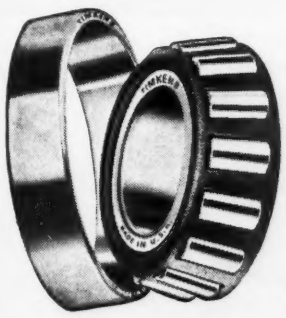
Timken bearings assure a smooth flow of power from initial drive to spindle nose. Gears are kept in precise mesh and alignment, the entire spindle assembly is rigid and free from vibration. And with Timken bearings, machine tools *retain* their precise, chatter-free performance even after many years of hard service.

There's no secret to keeping shafts in rigid alignment

Here's an engineer's rough sketch of a typical transmission countershaft equipped with Timken bearings. Due to the line contact between rolls and races, you get maximum load carrying capacity with no chance for shaft deflection or misalignment.

And because the tapered design takes thrust as well as radial loads, end-movement of the shaft is eliminated. Positive shaft alignment is another big reason why 9 out of 10 bearing applications can be handled more efficiently with Timken bearings.





TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

Want to learn more about bearings?

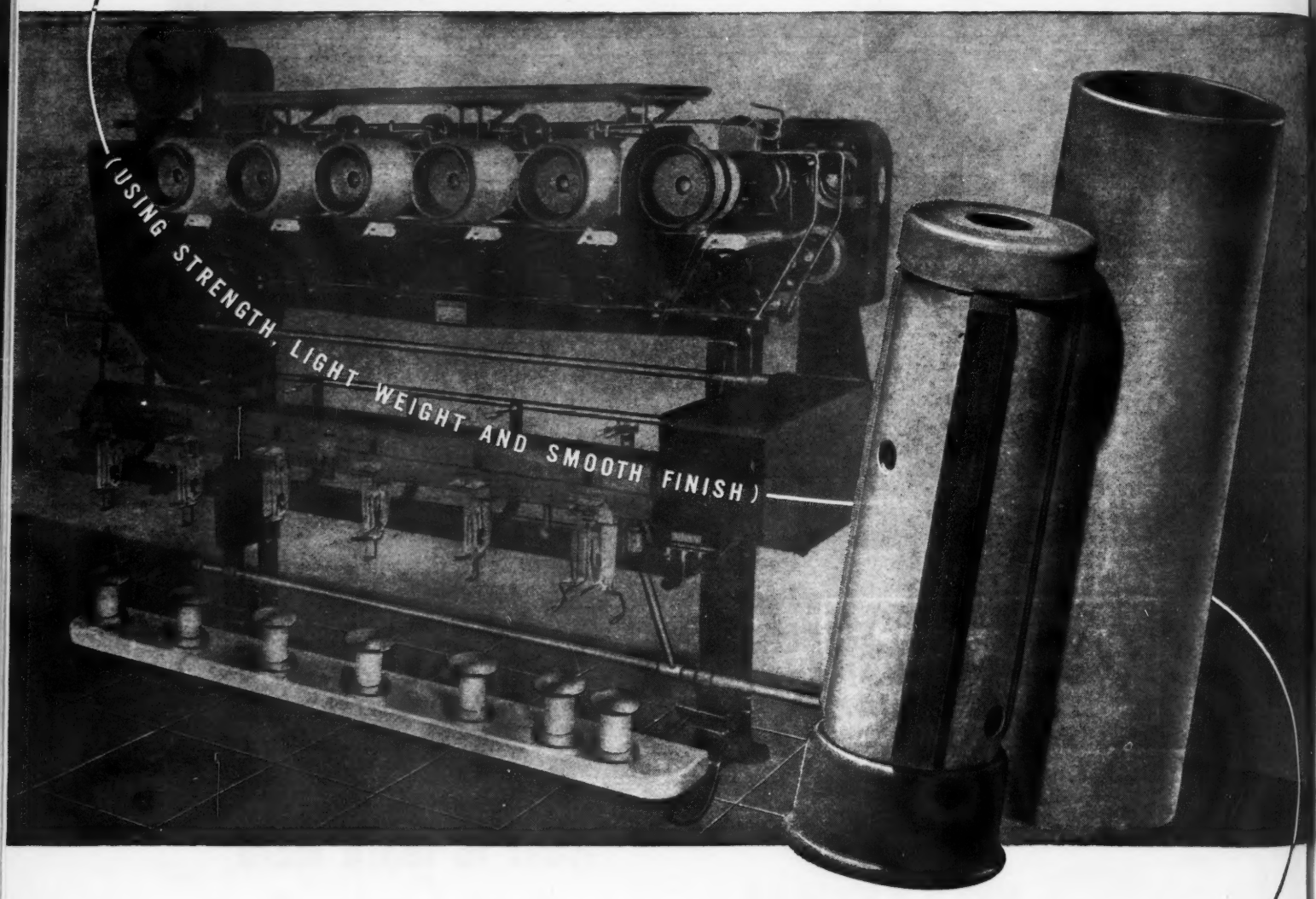
Some of the important engineering problems you'll face after graduation will involve bearing applications. If you'd like to learn more about this phase of engineering, we'd be glad to help. For additional information about Timken bearings and how engineers use them, write today to The Timken Roller Bearing Company, Canton 6, Ohio. And don't forget to clip this page for future reference.

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◎ AND THRUST —◎— LOADS OR ANY COMBINATION ✳

Plastics where plastics belong

Because of a unique combination of chemical, electrical, and mechanical qualities, Synthane laminated plastics can be applied to an endless number of practical purposes. Moisture and corrosion resistant, light-weight and structurally strong, Synthane has many collective advantages not readily found in any other material. One of the best electrical insulators known, Synthane is hard, dense, durable . . . quickly and easily machined.

Among the interesting occupations of our type of technical plastics are the redraw bobbin and chuck (below) used in winding fine denier nylon for women's hosiery.



Fine nylon filaments can be wound without pulling and sticking because of the smoothness of the bobbin. Light weight of bobbin and chuck allows the spindle to be started and stopped faster and with less effort. Greater crushing strength of tube permits larger amounts of nylon to be wound. This is an appropriate job for Synthane, an interesting example of using plastics where plastics belong.

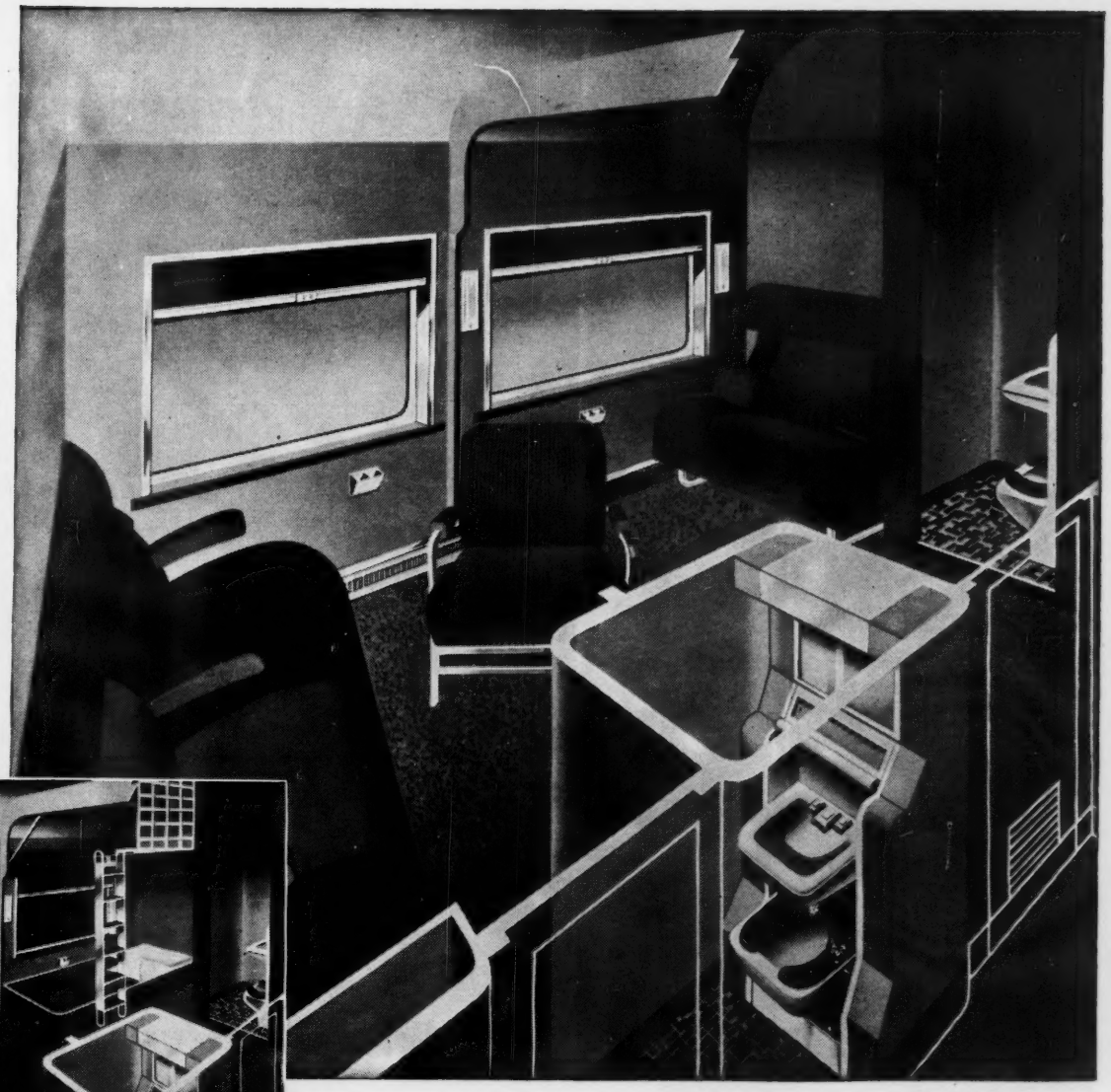
Synthane Corporation, 1 River Road, Oaks, Pa.

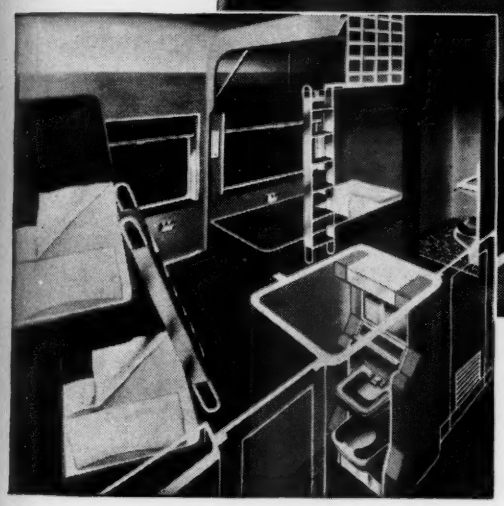
SYNTHANE

where Synthane belongs

DESIGN • MATERIALS • FABRICATION • SHEETS • RODS • TUBES
FABRICATED PARTS • MOLDED-MACERATED • MOLDED-LAMINATED

Budd is building all-stainless room-cars for the Burlington, Chesapeake & Ohio, Denver & Rio Grande Western, Missouri Pacific, New York Central, Norfolk & Western, Pennsylvania, Santa Fe, Seaboard, Union Pacific and Western Pacific.





Original...by Budd

Too often to be mere coincidence, basic improvements in railway passenger transportation originate with Budd. The most recent is this new sleeping car, now in service.

Just as the Pioneer Zephyr, built by Budd for the Burlington Lines in 1934, created the era of lightweight, streamlined trains, these new sleeper accommodations make previous design obsolete.

Illustrated are two double-bedrooms which have been combined into a Master Drawing Room, simply by folding back the panel which separates them. You can readily see how imaginative space-engineering has provided roominess, comfort and privacy. Seats for six by day; beds for four by night. Full-width, picture windows. Enclosed toilet facilities.

As was inevitable, an improvement of such obvious desirability is becoming the new standard for all sleepers. Many railroads are specifying it for their new room-car equipment, realizing that without it a car would be old before it ever carried a passenger. This post-war Budd sleeping car, of all-stainless steel construction, typifies the interest, effort and action Budd continuously devotes to more enjoyable and safer rail travel. The Budd Company, Philadelphia.

ORGANIC CHEMICALS—

Modern Medicine Men

The modern treatment of disease involves many factors—among which chemotherapy becomes more vital every day. In the treatment of disease and disabling allergies, medicines synthesized from organic chemicals have replaced many of the less specific medicinal agents of past generations.

Such medicinals as the sulfonamides, penicillin, streptomycin, anti-histamines and aspirin, either comfort the patient or make the control of his illness far more certain and effective. In each case the broad availability of these drugs has been made possible by the development of synthetic organic chemicals which are necessary to their manufacture.

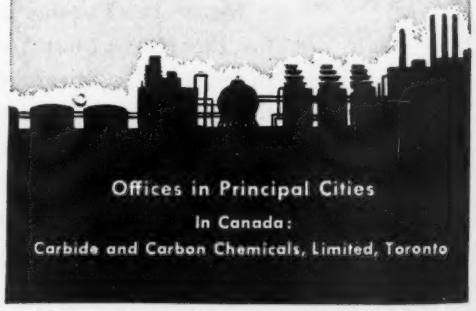
Carbide and Carbon Chemicals has pioneered in synthesizing and producing, on a large scale, dependable organic chemicals. Our technical representatives are well qualified to help you make the best use of them in the development of your product.

A partial list of our chemicals, now considered basic to the pharmaceutical industry, includes the alcohols: methanol, ethanol, and isopropanol; acetic anhydride; propylene glycol; ethyl ether; ethyl and isopropyl acetate; acetone; ethylene dichloride; "Carbowax" compounds; acetoacetic esters; and the ethanolamines For specific information on any of these materials, their chemical and physical properties, and their reactivity, call or write our nearest office for "Synthetic Organic Chemicals," booklet B.

CARBIDE and CARBON CHEMICALS CORPORATION

Unit of Union Carbide and Carbon Corporation

30 East 42nd Street UCC New York 17, N. Y.



Offices in Principal Cities

In Canada:

Carbide and Carbon Chemicals, Limited, Toronto

"Carbowax" is a registered trade-mark of C. & C. C. C.

the tech engineering news

May 1948
Vol. XXIX No. 7

The Future of M. I. T. 279
By Dean Everett Moore Baker

The Past 282
By Harry F. Smith, '51

Open House 284
By Louis H. Washauer, '50

Physics at Tech 287
By Professor John C. Slater

Solar Heating 288
By Walter R. Stahl, '51

The National Student Association at M. I. T. 290
By Lawrence L. Lortscher, '51

Of and For the Students 292
By John W. Weil, '48

Cover Design by Charles M. Jordan, '49

MEMBER OF THE ENGINEERING COLLEGE MAGAZINES ASSOCIATED

Published monthly during the school year at Walker Memorial, Cambridge 39, Massachusetts, by the undergraduates of the Massachusetts Institute of Technology. Entered as second class matter, at the Post Office, June 1, 1920, at Boston, Massachusetts under the Act of March 3, 1879. Copyright 1948 by The Tech Engineering News. Subscription per year $1.50. Foreign $2.25. One copy 25 cents.

from the editor's notebook

A glance at the title page for this month's *T. E. N.* shows that the articles are about M. I. T. This issue reflects some of the spirit of Open House, being held on May 1. While the latter is trying to acquaint the public more fully with M. I. T. on the academic, research, and social sides by enabling it to visit the school and be taken on a tour by student guides, we are attempting to do much the same for our readers through our articles.

M. I. T.'s past record stands out brilliantly, but its future looks even brighter. No account of Tech would begin to be comprehensive without a look at the plans for the future. **Dean Baker** writes for us this month as a man who is intimately concerned with these plans. Dean Baker became Dean of Students in October, 1946. Prior to that time he had been active with the American Unitarian Association as Vice-President for a while and also as minister of a church in Cleveland. The office of the Dean of Students is particularly concerned with student welfare, especially with regard to student government and all other forms of undergraduate activity. As can be seen from Dean Baker's article, many of the projects for further improvement being undertaken involve making the atmosphere in which the student lives even more healthy.

T. E. N.'s historian, **Harry Smith,** dug out the facts about M. I. T.'s past and wrote them up for us. Harry, a Freshman staff member, continually stated he was interested in writing non-technical material, and with the May issue on M. I. T., we found something for him. Of late, Harry's home has been in Tamqua, Pennsylvania, but three years ago it was Philadelphia. Although still not definitely decided on what course of study to follow, he says it will be something between Electrical Engineering and Mathematics.

Lou Washauer came from Clayton, Missouri, in the fall of 1946 to study Mechanical Engineering at M. I. T. As a member of the Open House Committee, he was ideally suited to write an article telling what is on display during Open House Day.

When *T. E. N.* decided to try to cover M. I. T. for its readers, we thought that one article should describe a typical department at Tech. We were very fortunate, indeed, when **Professor Slater,** head of the Department of Physics, agreed to give us the inside information on his domain. Professor Slater received his Bachelor's degree from the University of Rochester in 1920 and then did graduate work at Harvard and in Europe at Cambridge and Copenhagen. He left Harvard in 1930 to come to M. I. T. as head of the Physics Department. In addition he is a member of the staff of the Institute for Advanced Study at Princeton and on the technical staff of the Bell Telephone System.

Walter Stahl has such a diversity of interests that it would be hard to list them all. Recently photography has been his main hobby. Walter's home is in Jackson Heights, Long Island, but he attended Brooklyn Technical High School before he entered Tech. Although an Engineering and Business Administration student, his interest in research was strong enough for him to spend quite a bit of time this term becoming our authority on solar energy.

As Secretary of Tech's NSA, **Larry Lorscher** is in a position to give us facts on what the NSA is and how it differs from former nation-wide student organizations. Missouri can claim two of our authors this month, for Larry as well as Lou Washauer hails from that State. He graduated from high school in Kansas City and then spent a year and one-half in the Army before entering Tech.

T. E. N.'s ex-General Manager, **John Weil,** formally enters the running for writer of the year with his article on the Institute Committee. "Of and For the Students" is his third article this school year. The other two were on television and nuclear engineering. John has been on the Institute Committee for over a year and at present is on the Executive Committee of the Institute Committee, so he was the logical man for us to turn to when we conceived of an article on undergraduate activities in their relationship to the Institute Committee. John is a senior now in Course XV, but most of his electives have revolved around nuclear engineering, and it is that field which he plans to enter.

the future of m. i. t.

Everett Moore Baker

Dean of Students

The only sure statement that can be made about the future of any institution is that there can be no certainty. To make any predictions about the M.I.T. of 1958, '68 or '78, which dates are easily thinkable, especially to our present seniors, would be presumptuous. What follows here, then, is not prophecy but speculation. Perhaps it is what a young poet once suggested possible: Hope striving to create the thing it contemplates.

These are times when speculation about the future is fraught with unusual uncertainties. Guessing the future of American education is no easier than to venture description of the future of American politics or economics. We can be reasonably certain that higher education will continue to be a major influence in American life and research will be its stimulus. But if America of tomorrow is to fulfill its hoped-for destiny as the land of the free, then higher education must take to itself again some of its lost functions as well as assume responsibilities not yet fully understood.

Technological education is for professional competence. The study of engineering and sciences is as good a preparation for living in a free democratic society as the study of liberal arts. The question today is not which is better; it is rather, how can both be made more nearly adequate as preparation for living in the kind of culture that we want.

There is little doubt that the students of our colleges and universities are motivated primarily by expectations of higher earning power. If in the next decade, as has been estimated, our college enrollments double in number and our economy does not keep pace, then a bachelor's degree will no longer be a guarantee to the measure of economic security that has been assumed. The current emphasis on highly specialized vocational and professional education must make room for a greater concern for education for the special responsibilities of living in a cosmopolitan democratic society in order that the present devisive factors of prejudice, greed, and ignorance shall be purged.

This I believe to be true of the total educational pattern of America. I do not believe, however, that this necessarily applies to certain specialized professional schools of highest rank. M. I. T. is one of these. Our policy of limiting admission and stabilizing our enrollment in our several courses according to the demand for our graduates and the maintenance of highest possible standards should give us reason to expect that no matter what the total college enrollment in the United States, our function shall continue to be to provide the best possible scientific and engineering education not only for the highest qualified students of our own land, but for the outstanding potential scientists and engineers from all the world.

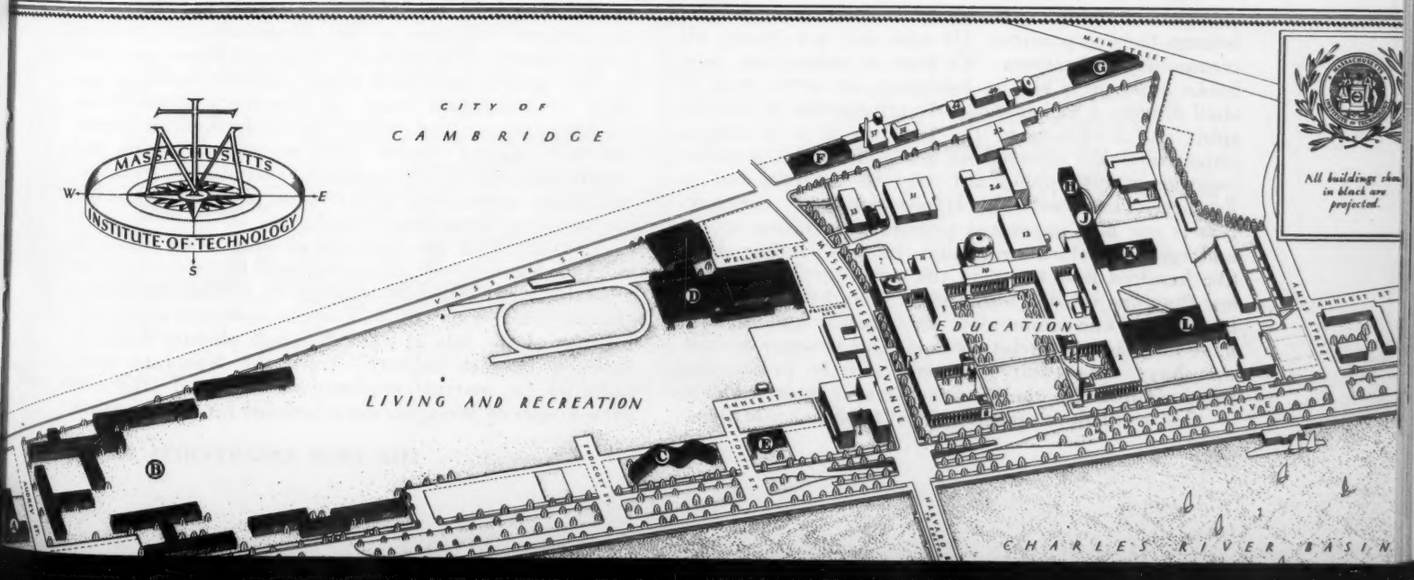
This, however, is not enough. If we are to continue as an undergraduate, four year college and graduate school, and if the emphasis in the pattern of higher education of America is to be away from vocational toward broader more general curricula, then we, too, must add greater strength in our extra-professional divisions. This we should, of course, continue to do regardless of the pattern of education elsewhere. The awareness of the necessity for shift in emphasis in other institutions makes us more alert to our own responsibilities.

There are three methods by which we at M. I. T. can broaden our educational program so that it shall be unexcelled as preparation for professional careers in science and engineering and at the same time offer more substantial foundation upon which our students can "build more stately mansions" in which to live as self-reliant, responsible citizens of their own free, democratic society.

The details of these methods, and others, are the subject matter of the very thorough study now in progress by the Faculty Survey Committee, headed by

M. I. T. of the future. *A.* Supersonic Wind Tunnel. *B.* Future Dormitories. *C.* Senior House. *D.* Gymnasium-Auditorium. *E.* Faculty Club. *F.* Metals Processing Laboratory. *G.* Hydrodynamics Laboratory and Towing Tank. *H.* Electronics. *J.* Biology and Food Technology. *K.* Nuclear Science and Engineering. *L.* Library

M. I. T.



Aalto

Tech's unusual new "zigzag" Senior House, now under construction

Professor W. K. Lewis. The report of this committee cannot be expected for another year. The recommendations of this committee undoubtedly will affect the future of the Institute insofar as any internally determined policy can.

These three major methods by which we can change our emphasis are: (1) by becoming a graduate school and thereby allowing opportunity for all students entering the Institute to acquire broader cultural foundation before matriculation; (2) by revision of our present curriculum to make possible further emphasis on the humanities and possibly by adding one more academic year; (3) by continuing the present curriculum (with perhaps minor changes and revisions) and adding considerable extra-curricular influences to afford our students, so definitely limited by the requirements of their courses, greater opportunity to secure a larger portion of the enriching experiences more easily available in a liberal arts college.

The Faculty Survey Committee has received all three of these recommendations, among many others. About the first two I shall have nothing to say. About the many possibilities under the third suggestion I shall comment in some detail. It should be obvious, of course, that there is no intent here to outline a definitive program for the future of the Institute.

What, then, are the considerable extra-curricular influences of the future educational program of M.I.T. which I believe can contribute greater enriching experience gauged to increase our graduates' understanding of their "one world" and equip them better to live happily in it? These changes I hope for in the future of M. I. T.

Housing

One of the great needs for our modern society is a sense of belonging in the minds of its citizens. He who belongs feels responsible. He who does not ignores his community obligations. We learn *to belong* not from books or lectures but by *belonging*. In order that we shall develop a higher sense of participation in the life, spirit and traditions of the Institute it is of utmost importance that more of our academic community live together. This applies not only to students but to Faculty. The new Senior House now under construction is our first important permanent addition to our undergraduate dormitories since 1930. Including about five hundred now living in the temporary "barracks" less than one third of our student body live together as members of our community. Our Faculty and students have no residential relationships. Our younger instructors have opportunity for only strictly professional relationships with their colleagues and their students.

One great development of the future should therefore be more housing "on campus" for both students and Faculty. The proposed apartment to be built east of the President's house and the new Senior House are important first steps toward the meeting of this need. The Senior House, however, will take care of only about three hundred and sixty-five whereas the temporary barracks now accommodate over five hundred. There must be more dormitories, three, four, or five, before we shall have a situation conducive to the kind of living together that promotes a feeling of membership upon which can be built a social conscience.

The Westgate West area, now occupied by the two-story apartments for married veterans, and scheduled for such use for at least four more years, is the obvious best location for additional permanent dormitories.

Somewhere on the Cambridge side of the Charles and within walking distance from the Institute there should be land available for those fraternities whose present locations are inconvenient for efficient student living. There is little possibility that individual fraternities could plan and finance new houses, but under an overall Fraternity Project sponsored by the Institute for such fraternities as may care to participate a plan could be developed.

Whether or not we should ever have Faculty house masters in our future or existing dormitories is a debatable question. However, there can be no question about the desirability of bringing students and Faculty closer together. Resident house masters in some if not all of our dormitories might help to further this relationship. An extra-professional, residential, and social relationship between students and Faculty would enrich both groups and strengthen the feeling of community.

Athletics and Recreation

The outlines of the new John Rockwell Field House are now visible. This new building will add two indoor playing areas each 165 x 100 feet, one for track field events and an indoor board track, the other for baseball, lacrosse, soccer, badminton, volley ball and other sports. The John Rockwell Field House in addition to our present daily use of the Massachusetts Avenue State Armory with its four basketball floors provides us with greatly improved indoor athletic facilities but there is still great need for adequate gymnasium facilities for our own intercollegiate basketball games and other indoor sports. Our ten squash courts are insufficient for 4,500 students and 1,000 Faculty. Additional gymnasium facilities are planned and await the securing of necessary funds.

By the fall of this year the playing fields that will be graded and seeded this spring will increase the total available area west of Massachusetts Avenue by almost 100 per cent. This still will not be sufficient especially because of the loss of some baseball playing fields to the new Hayden Library. Until the Westgate communities for married students are removed (the 100 little houses of Westgate are scheduled for amortization

in 15 years), there is little chance of any increase in playing field space. With the eventual erection of a large new student housing unit on the Westgate site, at least one half of the land area now occupied by temporary houses should be available for more playing fields, tennis courts and campus.

New and Additional Laboratories

The Corporation plans for the future call for five new laboratories in addition to the Supersonic Wind Tunnel now under construction on Memorial Drive beyond Westgate. North of Vassar Street behind the main buildings will be located a Metals Processing Laboratory and an Hydrodynamics Laboratory and Towing Tank. North of Building 8, where the old Radar Laboratory (the Barracks) stands, will be built two new laboratories, Electronics plus Biology and Food Technology. East of Building 8 will be built the new Nuclear Science and Engineering Laboratory. All of these projects, of course, await the securing of funds which the Corporation is now actively engaged in seeking.

Library and Humanities Center

This spring construction of the new Hayden Memorial Library will begin. The planners of the new library building have conceived of it as serving a dual but consistent purpose. As the nucleus of the Institute's departmental library system and itself a great repository, it will provide the most serviceable collection possible of advanced research and teaching material in the scientific, engineering, and architectural disciplines to which M. I. T. is primarily devoted. In addition, however, it must serve the humanities program and the nonprofessional development of the students by offering them the maximum invitation to the many important fields of thought and inspiration outside the required curriculum. This concept recognizes that the humanistic responsibility of the Institute's library is in some ways even more far reaching than that of the libraries of the great liberal arts institutions.

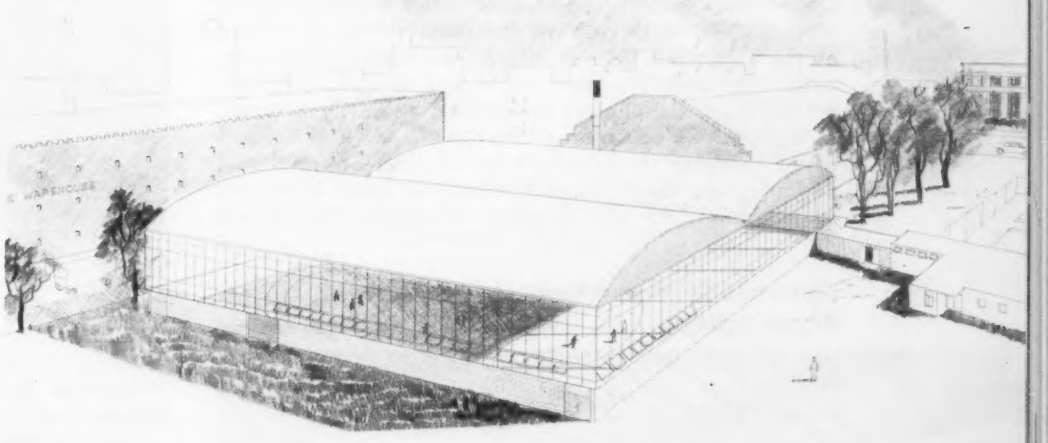
The Charles Hayden Memorial Library will be a great deal more than a conventional library. It will house, for example, the Institute's departments in the social sciences and the humanities so that they will be contiguous to their libraries, which are in effect their laboratories. In addition to this formal implementation of the humanistic program, the new library will seek to facilitate the student's examination of various cultural heritages which cannot find a place in the formal curriculum. The already large collection of recorded music possessed by M. I. T. will be housed in carefully designed quarters in the new building as part of an audio-visual center."*

Student Government

Whatever the reasons, and there are several, we have at M. I. T. a higher degree of responsible student government than any college or university in the United States. We do not have as broad a base of participation in student government as in many colleges. The portion of participation in class elections is far too small. I believe that if we are to continue the high level of student government autonomy and increase student responsibility, then we must have greater participation. At present too few students are active in extra-curricular affairs, either athletic or non-athletic. There appears to be a noticeable change for the better at the present time. In the future student extra-curricular activities should be more important factors in the total educational patterns than at present and our position

* From M. I. T. — A New Era.

(*Continued on page 296*)



Artist's view of the projected Charles Hayden Memorial Library appears to the left while above is a drawing of the John Rockwell Field House, now under construction

the past

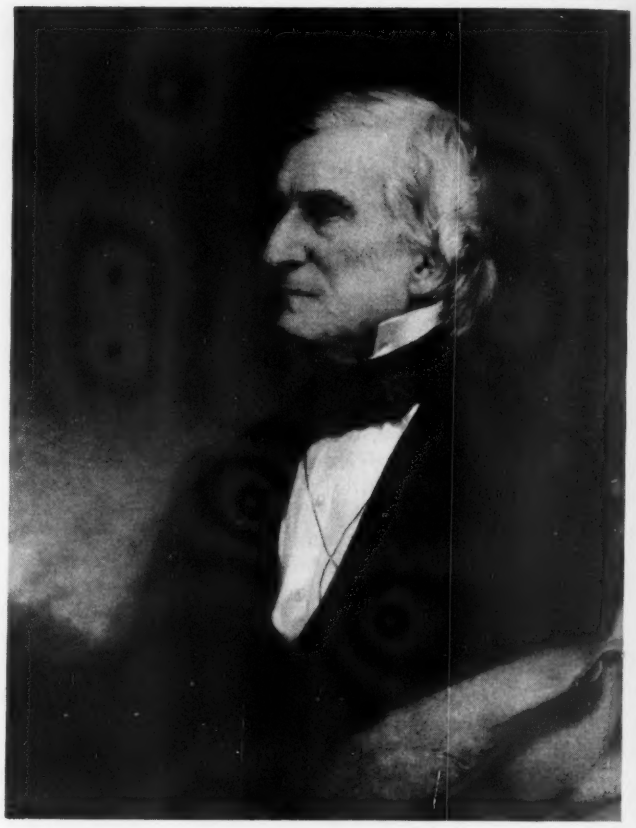
Harry F. Smith, '51

The advent of the Industrial Revolution in America made it increasingly apparent to businessmen and manufacturers that their own skills were insufficient for the building of a highly technological economy; however, this realization of the growing need for trained engineers was slower to impress itself upon the minds of those who could amend the situation. Among those who did possess both the intellectual qualities and the experience with which to anticipate this state of affairs was William Barton Rogers.

As early as 1846, he began to plan with his brother Henry the establishment of a "comprehensive, polytechnic college" for a "complete system of industrial education." Boston, with its knowledge-seeking atmosphere, was the natural location for this new Institute. Still, it was February 18, 1859 before his plans had materialized even to the extent of a preliminary meeting. On that date, forty interested businessmen and other representatives decided at a caucus in the rooms of the Boston Historical Society to secure, if possible, a grant from the open land in the Back Bay area for the establishment of the Institute.

On April 10, 1861, Governor Andrew finally affixed his signature to their charter and simultaneously presented them with the problem of either raising $100,000 within a year or having the document revoked. When, at the expiration of this time, they found themselves with only $40,000, they succeeded in extending the provisions of the charter for another year. Once again, though, the all-consuming effort of the Civil War hampered them in their endeavors, so that on their last day of grace they found themselves little better off than before. At this dramatic moment, the unborn

William Barton Rogers — a portrait by Lazarus
Technology Review



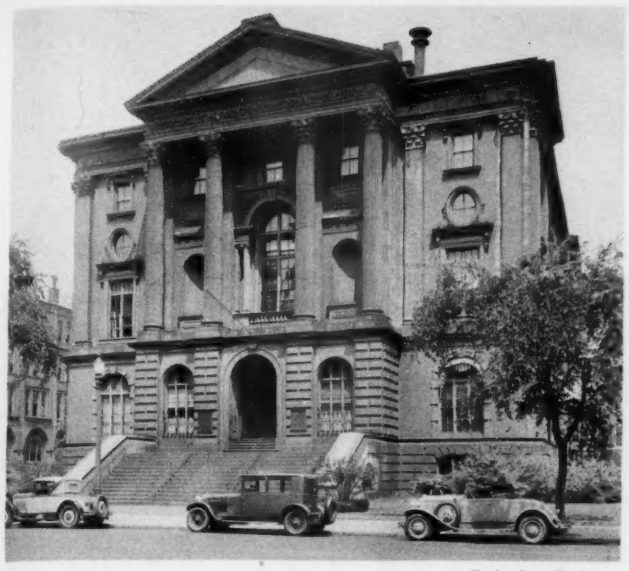
Commons Room and fireplace in the old Rogers Building
O. H. Davis

Institute found its first benefactor in the person of Dr. William J. Walker, retired industrialist, who suddenly bequeathed a gift of over $60,000.

This settlement, Dr. Walker's subsequent bestowal of an additional $200,000, and later generous bequests both of money and of land by the Commonwealth made possible an enlargement of the proposed plans. The present charter, as it went into effect at that point, really provided for a corporation to consist of three parts — a Society of Arts, a Museum or Conservatory of Arts, and a School of Industrial Sciences and Arts. The Society of Arts was originally the governing body of the Institute; and even before the School was opened and instruction begun, the Society presented several lectures to the general public throughout that winter. Since that time, although the Society of Arts has continued to sponsor free lectures which have covered practically every phase of scientific progress in the last eighty years, it has become secondary in importance to the School.

The Museum was destined to never even reach that stage of development and has served from the beginning as a source of exhibits for students in various professional departments.

Consequently, the name M. I. T. is generally



Technology Review

Rogers Building, an example of the influence of French architectural thought on American technology in the mid-eighties

understood to refer to the School of Industrial Sciences and Arts.

In February of 1865, school was opened in leased rooms of the Mercantile Library Association on Summer Street and in the home of Judge Jackson Rowe. Both of these buildings, since destroyed in the fire of 1872, were evacuated in the fall of 1866 as the young Institute moved into its first permanent home, the Rogers Building. This was a handsome edifice for its time and was much larger than called for by the immediate needs. The vision of President Rogers was justified, however, in the early eighties and early nineties, when it became necessary to erect, successively, the Walker Building and the Pierce Building. Fourteen students became M. I. T.'s first graduates in December, 1868.

At this point, John D. Runkle assumed the presidency and allowed the wearied Rogers to take a brief rest. The administration of Technology's new head was an eventful one and a strenuous one. It marked the admittance of M. I. T.'s first woman student, Ellen Swallow; she later married Robert Hallowell Richards, centenarian member of the first class of '68 who was continuously connected with Technology, first as an instructor and later as a professor emeritus, until his death in 1945.

Further, it was Runkle who adapted to the Institute the Russian manual system on the basis of his observations at the Centennial Exhibition in Philadelphia. A radical change from the machine-shop practice then prevalent in America, this method emphasized giving the student an intelligent, comprehensive education in shop technique rather than teaching him to become blindly proficient in the production of a few specialized items.

The panic of 1873 served to make his role particularly difficult because, in the atmosphere of a Boston that was still too imbued with the spirit of Harvard to completely welcome the new school, the Institute found itself suddenly in shallow financial waters. Monthly, the board would meet to consider whether they should give up the project then and there or should try to weather the storm a little longer. Fortunately, the young school found another benefactor at this point in the person of John Cummings, Institute Treasurer, who, by digging deep into his own pocket, enabled it to continue its existence.

During these trying seventies, it was frequently suggested that M. I. T. become a part of Harvard University. Runkle's opposition to this plan closed the issue until the administration of President Pritchett.

The advent of the eighties marked a steady period of growth and prosperity. Most influential in bringing the Institute to the maturity which it attained at this time was President Francis Amasa Walker, a former government official and a national figure. His efforts were largely responsible for the development which necessitated erection of Walker and Pierce Buildings.

Of importance because of the revival of the Harvard merger plan was the presidency of Henry S. Pritchett. This time, the strenuous objections of Technology alumni determined the matter, closing the matter for all time as well as retaining for the Institute its immediate independence.

By 1910, it had become evident that M. I. T. must either grow skyscraper fashion or must seek a new home, for no more land was available in the Back Bay area. President Richard C. Maclaurin was the man who cut Technology loose from its old ties and started it on its new life in Cambridge. He found the mysterious Mr. Smith — in reality George Eastman of the Eastman Kodak Company — who promised $2,000,000 toward the new Institute if the Corporation could raise an equal amount from other sources. With the impetus thus gained, M. I. T. moved across the Charles River in 1916 on the famous barge *Bucentaur*. Fittingly enough, the inscription on the foyer wall overlooking the Great Court really dedicates this structure to Dr. Maclaurin.

The move was actually made before the new home had been completed; since that time, continuous additions have been made to technology: the Mining Building (Building 8) in 1917, the Guggenheim Aeronautical Building (Building 33) and the Homberg Infirmary in 1928, the Sloan Automotive Laboratory Building (Building 31) in 1929 and 1940, the Eastman Research Laboratory Building (Building 6) in 1933, and the Wright Brothers Wind Tunnel Building

(*Continued on page 298*)

The old Mercantile Building on Summer Street: birthplace of the Institute on February 20, 1865

Technology Review

open house

Louis H. Washauer, '50

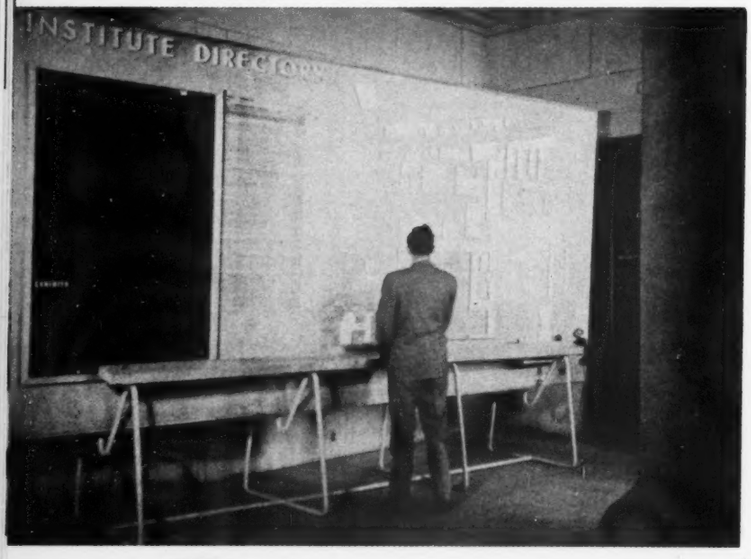
With exhibits, lectures and demonstrations planned by all Institute departments and student activities, the visitor to M. I. T.'s 1948 Open House will have a busy day. Considering the multitude of exhibits, lectures, and demonstrations it will be almost impossible for anyone to see everything. In order to help the guests see what they are most interested in, there will be a set of conducted tours, each of which will cover a certain phase of Institute activity. These are organized to aid everyone to see and hear everything. At each exhibit there will be men to explain what is shown and answer questions.

The purpose of Open House is to present life and activity at M. I. T. *as a school* to the community and the nation, and to inform the community of the latest scientific developments. Technology is a school, but above all, it is a place where people live. As such, activities are organized in two major fields, scholastic and extra-curricular. The ability to become an integral part of the community is essential to the student's education, especially at M. I. T., where the scientist and engineer of tomorrow are at work. Consequently, Open House exhibits are of two types: student activities, and the technical studies of the different departments.

It is difficult in many fields to portray the work which is being done by the department, since much time is spent in routine laboratory work, all of which, however, is necessary in adding to that basic knowledge which makes the modern world a more comfortable place. Let's take a look "behind the scenes" and see what some of the exhibits represent in the way of past contributions and present work in the various fields.

The Aeronautical Engineering Department will show guests the type of work which lies behind the construction and use of the airplane. The main feature of the exhibit will be the operation of several wind tunnels. Behind the use of such tunnels lies a twofold purpose: basic research in airplane design, and testing of equipment for airplane manufacturers. These tunnels simulate controlled flight conditions with no danger to a pilot or personnel. The Open House guest will have an opportunity to see just what goes on during such tests. But modern aeronautical research has other tools of an important nature. There will be an exhibit of some types of plane structures with demonstrations of the methods of testing their strength characteristics. This exhibit well illustrates the complexity of airplane design. To make air travel safer and more efficient automatic control devices are being studied extensively. Fire control and automatic piloting are the primary research subjects.

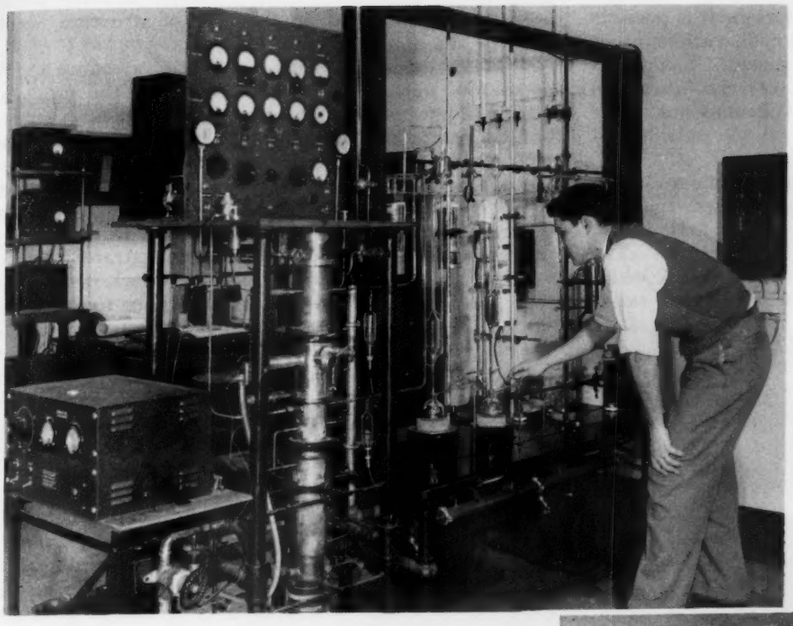
On this model of the campus, buildings can be located by pressing indexed buttons, whereupon a light shines to indicate the appropriate building



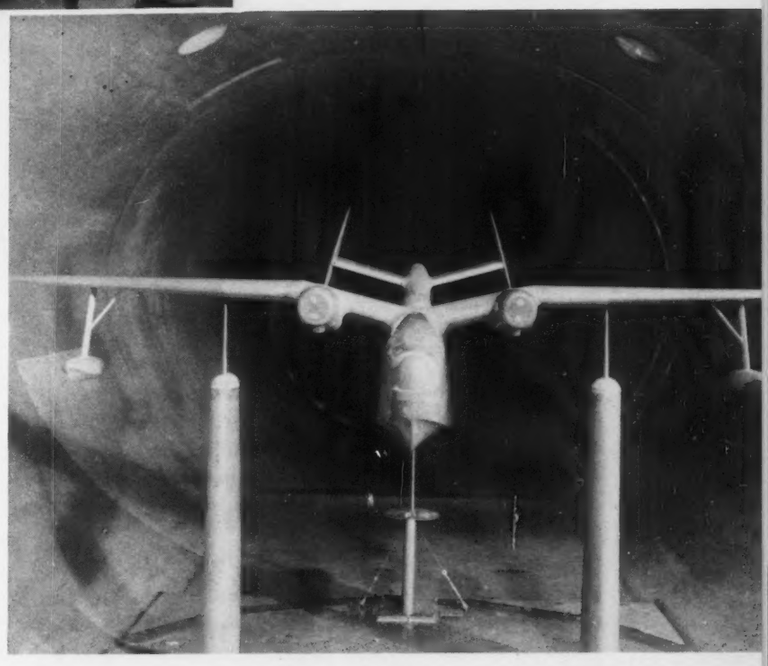
In considering the more dynamic technical fields one is liable to overlook such work as that done by the Biology Department, but their work is of extreme importance to every individual, for it is this field which is adding so much to our knowledge of the life process, and is equipping modern medicine with the tools it must have to combat disease. One of the most important tools in this research is the electron microscope, which is capable of magnifications one thousand times more powerful than ordinary microscopes. The instrument will be exhibited and explained by students in the department. Microbiology is of great importance in medicine, for it is from research in this field that penicillin and streptomycin have been developed. In an exhibit covering this phase of biology the general use of micro-organisms as a medical tool will be shown. Another interesting exhibit will be a comprehensive display of embryos in various stages of development. It is interesting to note that in many such developments it is possible to observe changes in the animal similar to the evolutionary changes that have occurred through the ages.

Modern biology is a science which integrates the methods of physics and chemistry and applies them to the study of life in nature. Perhaps the best evidence of cooperation is such instruments as the electrocardiograph for study of the heart, and diathermy machines for therapeutical work. Such equipment has already helped many people live a longer and healthier life.

In the areas of comfort and convenience, the Meteorology Department is constantly learning more about that chief source of conversation — the weather. From the shrewd guessing game that it once was, meteorology has developed into a relatively precise science. The weekly forecasts now published in many newspapers are a direct result of the ten-year program in long range forecasting that was carried on here. M. I. T.'s department has developed the five-day forecast system which is now being used by the Weather Bureau. Most of the work now is directed at the application of radar techniques to weather observation and forecasting. The department's exhibit will show the Open House guest the type of work which will soon be used for general meteorology practice. Radar apparatus will be in use,



Molecular beam apparatus in Physical Chemistry Research Laboratory



Model of Martin PBM in Technology's Wright Brothers Wind Tunnel
Aeronautical Engineering Department

plotting the amount and nature of cloud formations within many miles of the Boston area, thus permitting observation of approaching weather conditions without the danger and expense of sending airplanes aloft for direct readings. Most of the work now is in the nature of calibrating instruments and determining what interpretations are to be made of radar observations. In use will be a wind tunnel designed for calibrating instruments under all weather conditions, the instruments then being used directly to check the validity and nature of that which is seen on the radar scope.

One of the most spectacular of the Open House lectures will be that on "Fire and the Control of Fire" to be presented by Professor A. R. Davis of the Chemistry Department. Having been presented extensively in and around New England, the lecture is designed to familiarize the public with the nature of fire and the various techniques used in its control. Many experiments of a dynamic nature are promised to illustrate the main points. This should be of interest to everyone due to the subject matter and the highly enjoyable presentation. To illustrate the principle behind use of atomic power, the Chemistry Department will also present a lecture explaining these phenomena in readily understandable terms. Included will be demonstrations showing nuclear power phenomena in action. The sub-microscopic activity will be represented on a vastly enlarged scale to be visible to everyone.

In this age of increasing use of mineral resources, the work of the Geology Department is becoming more and more important. The exhibit by the department will illustrate the twofold nature of their work. In planning locations and extent of mining projects, field surveys are of great use in leading to the most efficient use of our gradually diminishing resources. In the laboratory, the geologist conducts research into the properties of materials and their basic crystalline structure. The research is in two fields: theoretical studies of matter in general, and study of specific materials considering their actual use in industry. Demonstration of both types of study will be shown, including the projects now being carried on to aid petroleum and other industries.

A newcomer to the technical field is the science of Food Technology. M. I. T. was one of the first schools to establish a department in this important field. Since the inauguration of the Pure Food and Drugs Act, the nation, and the world, have become more and more conscious of the importance of controlled quality in the food industry. The work at the Institute is aimed at teaching students the techniques used in industry to assure uniform high quality, and to develop and improve such techniques. A model bakery in which the methods of the baking industry are studied will give guests an opportunity to see this type of work in operation.

In putting food products on the market, packaging becomes a major problem. How testing and development of packaging methods is accomplished will be demonstrated by the laboratory research which will be shown in action. The new system of electronic cooking is being studied and one type of "Radarange" will be

shown in operation. With such a machine it is possible to boil water in twenty seconds or cook various other types of foods at corresponding speeds. Using this method, food can be cooked all the way through at the same time, preventing that common phenomenon of the roast beef that is almost scorched on the outside and almost raw on the inside.

The Department of Building Engineering and Construction is unique in the fact that it offers the only course in the country devoted to the study of the design, construction, and management of buildings. The department has developed research programs which involve different phases of construction and their materials. Intensive research is conducted on plastics, cement and other building materials. Part of this program is devoted entirely to the testing of new or improved material for different sponsors. The department's exhibit is divided in two parts. First, all laboratories where research is conducted and where students do their practical work will be open to the public, with demonstrations of all testing machines and apparatus. Secondly, the exhibits will consist of displays of new construction materials and methods. Included will be prefabricated materials which are coming into more extensive use. An interesting feature will be the exhibition of the Solar House on Memorial Drive. Here research is conducted on the type of structure which may be the home of tomorrow.

One of the major fields of scientific research today is that of nuclear physics. Devoted to the practical use of atomic power, the physics department is studying the complex nature of matter in its basic form. The department will have on display many of the machines used in its research, such as the cyclotron, synchrotron, Van de Graaff generators, and other high voltage instruments. The use of balloon flight in cosmic ray research will be another subject demonstrated.

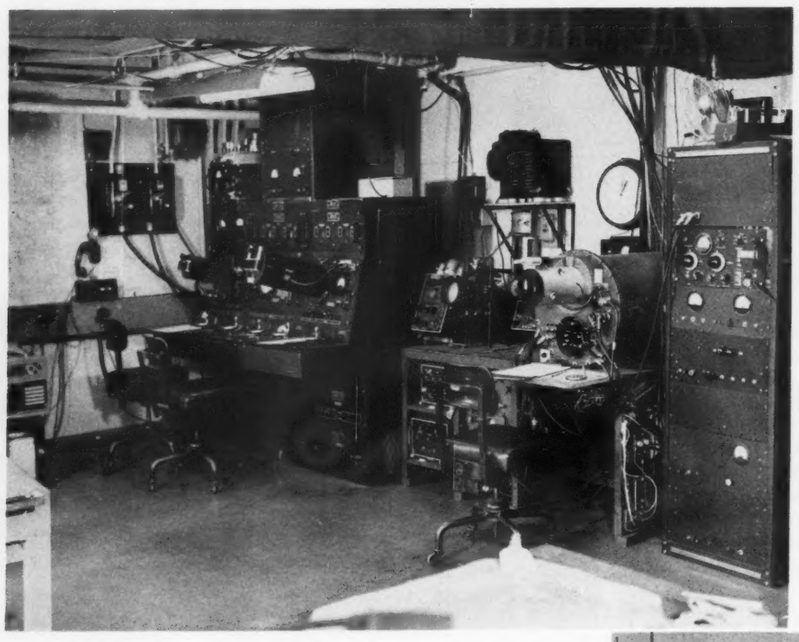
But the classroom and laboratory work is only one part of life at Tech. Of equal importance to the scientist and engineer of tomorrow is the problem of living and working with the community. To present a rounded education, much emphasis is placed on the extra-curricular activities which must form an integral part of college life. The Walker Memorial Building is the center of student life and activities. In this building the various undergraduate activities will demonstrate their purposes and accomplishments. The Walker Memorial Committee, coordinator of undergraduate activities, will provide special guides through activity exhibits.

In the fields of the arts, the Liberal Arts Society will have an exhibit of drawings and paintings done by Technology personnel. The Drama Shop, a group devoted to the Thespian arts, produces several plays each year and will display a large size model of a stage set recently used. The active Debating Society will meet a team from a liberal arts school on the subject "A Liberal *vs.* a Technical Education."

There are a number of organizations which are the outgrowth of hobby work. One of these, the Radio Society, will have an exhibit and will offer to send messages free to any part of the United States. Through a national organization, the Radio Society will be able to contact amateur operators in the localities to which the messages are being sent. The receivers will then forward the messages by telephone. All guests are invited to use this service. To provide an outlet for the varied hobbies Techmen have, the Hobby Shop offers facilities for photography, wood and metal working, glass-blowing, printing and a large number of other interests. The Shop will be shown with students at work.

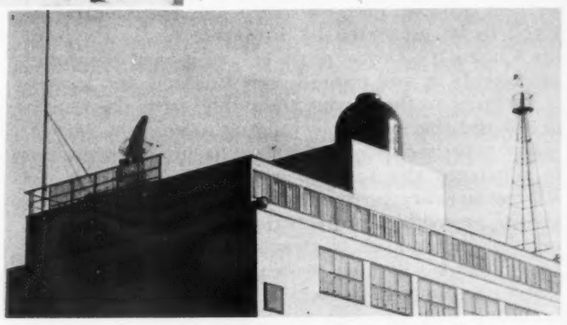
An integral part of student life is the athletic

(*Continued on page 300*)



Radar control room in Building 24, where storm front pictures seen by operators looking through the cylinders at radar "scopes" are used in controlling motion of data-gathering B-17 flying around in storm front

Meteorology Department



"Weather Eyes" on top of Building 24. At left, parabolic, automatically operated RHI radar antenna; center, canvas radome containing rapidly whirling PPI radar antenna; at right, weather tower. Operators located on next to top floor use the data from these radar sets to plot the weather fronts around Boston

Meteorology Department

physics at tech

Professor John C. Slater

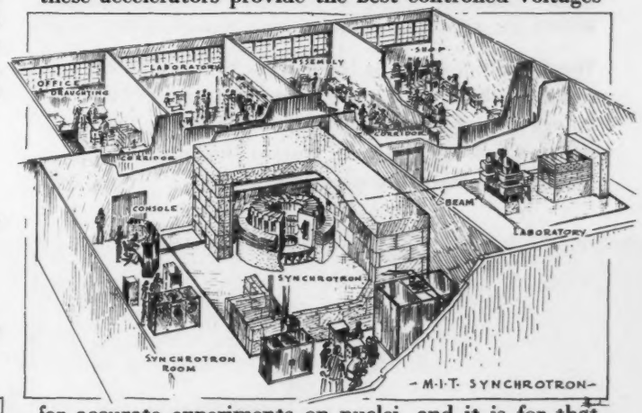
An Example of One of the Many Fields of Study at M. I. T.

Physics used to be a combination of mechanics, sound, heat, light, and electricity. The elementary physics course at the Institute, which all the students take, emphasizes largely those classical branches. Much of engineering is based on their applications: mechanical engineering on mechanics and heat, electrical engineering on electricity, and so on. But physics nowadays goes much further than this, and a good way of seeing this is to ask what some of the third and fourth year material of Course VIII comprises, both in course work and in the laboratory.

One of the third year subjects is atomic structure. Fifty years ago, no one knew how an atom was made. Now its construction from electrons and a nucleus is thoroughly understood. We have worked out the theory behind the periodic table of the elements, the nature of molecules and solids, in fact the whole theoretical background of chemistry, metallurgy, and the structure of matter in general. One of the most powerful tools for finding out about atoms and molecules is a study of the radiations they emit, or spectroscopy. In our third year atomic structure laboratory the students make a beginning at studying spectroscopy experimentally; earlier, in the physical measurements laboratory, they have learned some of the experimental technique required, like glass-blowing, vacuum techniques, and so on. The Institute goes much further with spectroscopy, however: the Spectroscopy Laboratory, a joint enterprise of the Physics Department and several others, is one of the best-equipped laboratories in its field in the world, and much of the recent advance in spectroscopy has been made by graduate students and staff members working in it.

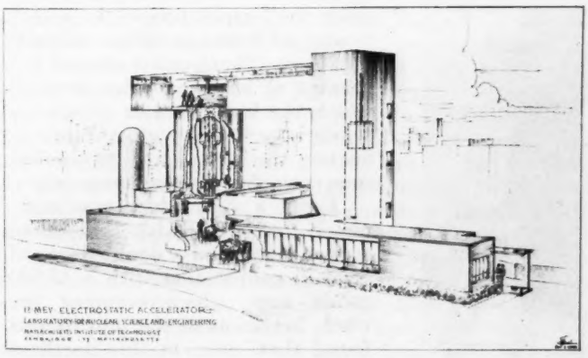
Another subject, now a fourth year elective but soon to be introduced in the third year, is nuclear structure. The nucleus of the atom is the part concerned in radioactive transformations, in nuclear fission, in atomic power and atomic explosives. Its study is a part of physics, and the undergraduates get a chance to work on it, largely at present in the senior laboratory. The ionizing particles sent out in radioactive disintegration are studied in Geiger-Mueller counters and in ionization chambers, and complicated electronic devices are used to make single atomic explosions observable.

Here again the undergraduate work is just the beginning of what the Institute has to offer. There are several graduate subjects carrying the students further; but beyond this, the graduate student, or advanced undergraduate carrying out a senior thesis, can use the facilities of the Laboratory for Nuclear Science and Engineering, an interdepartmental laboratory with outstanding facilities and staff. There are numerous high-energy accelerators, or atom-smashers. These include Van de Graaff generators, electrostatic devices developed here in the Institute, of which the largest one now in operation here reaches about five million volts, though construction will soon be underway of a machine designed for twelve million volts. Though these voltages are not very high by present standards, these accelerators provide the best controlled voltages



A view of the laboratory facilities housing the new 300 Mev. Synchrotron

The twelve Mev. Van de Graaff generator to be built at M. I. T.



for accurate experiments on nuclei, and it is for that purpose that we largely use them. Next in increasing voltage is the cyclotron. The Institute's cyclotron reaches voltages of about eighteen million, and is used mostly for producing artificially radioactive materials.

In addition to these instruments, which have been in operation for some time, the Institute is also building a synchrotron, a device for accelerating electrons to about three hundred million volts. The most interesting thing which we hope to do with this instrument is to produce mesons artificially. Mesons are particles of a type which until very recently were observed only in cosmic rays. There is every reason to think they have a fundamental relation to the structure of nuclei, a subject far less understood than the structure of the

(*Continued on page 302*)

solar heating

Walter R. Stahl, '51

An Example of Research at M. I. T.

On an ordinary sunny day in New England there is enough solar power striking an acre of ground to drive seventy-five passenger cars continuously at sixty miles per hour. Most of us have never known or considered this great potential source of energy and would find it difficult to utilize. Thanks to the work of some far-sighted individuals and institutions scattered throughout the country, however, the sun's rays will be available in a short time to heat our homes. It is perfectly possible that with the proper installations fuel bills can be reduced by seventy-five per cent or more in the northern parts of this country and completely obliterated, except for hot water heating, in the South; thus our limited fuel production will be available for other important uses. Ultimately, solar energy may heat all the dwelling places in the land and also be used for moderately high-temperature processes — perhaps even everyday cooking — through the use of concentrate radiation devices.

Some of the most promising research work in solar heating is being conducted under the auspices of the Architecture Department at the Massachusetts Institute of Technology. A special building has been constructed near the school which is specifically designed for experiments in solar radiation and is expected to provide conclusive data for designing solar-heated homes within a period of months. While it has been known for a long time that radiation heated homes are perfectly feasible, the paramount question was whether they would be able to compete with conventional heating systems. Therefore, in M. I. T.'s work the emphasis has been placed on discovering the least expensive installation which will still be reasonably efficient.

The first and most obvious type of solar heating is the one which makes use of a large expanse of windows on the south wall of a dwelling. When the sun is shining, the interior surfaces and air are heated up, but no attempt is made to collect and store its excess energy. In a series of experiments conducted at Purdue University under the direction of Professor F. W. Hutchinson, it was found that when using a building with approximately triple the south window area of an ordinary home, only ten per cent of the fuel bill was saved over a period of several winter months. Other disadvantages also became apparent. Even in the wintertime, on clear and sunny days there might be a tendency to overheat the building in the mornings when the sunshine would heat the windows most intensely; since in summer this would surely happen, some sort of eaves or shades would be necessary. Under the direct heating system all the solar energy that cannot be used immediately is wasted and there is no benefit at all on cloudy days.

One of the ways of storing solar heat so that it is available when the sun is not shining is to have it heat a liquid. Experiments have been conducted with houses part of whose roofs are covered with copper tanks, or copper plates to which tubing has been soldered, through which the liquid is allowed to circulate. Windows are placed above the blackened metallic surfaces in order to form a one-way conductor of solar energy. While glass readily transmits high frequency infra-red radiation as it comes from the sun, it is practically opaque to the much longer rays produced when a body is heated to 100 or 200 degrees F. Pumps keep the liquid (usually water because of its high specific heat and inexpensiveness) in circulation so that a large volume of it kept in tanks is all heated. When the sun no longer raises the temperature of the water, shades are drawn to reduce outward radiation. Thermostats control the passage of air over pipes through which the heated water circulates, slowly lowering its temperature and heating the house until an equilibrium is reached at room temperature.

Using a roof which was completely covered with blackened copper plates and a double layer of glass in conjunction with a 17,000 gallon tank which occupied the whole basement of the unit, it was found that, even in this northern latitude, a house could be com-

This building, which is located on Memorial Drive about a third of a mile from M. I. T., is the source of information which will help in the designing of all the solar homes that are contemplated within the next few years *W. R. Stahl*

W. R. Stahl

A picture showing the interior of one of the cubicles. The controls, recording devices, and auxiliary heater are visible; John Juetcher, Jr. is operating one of the shades

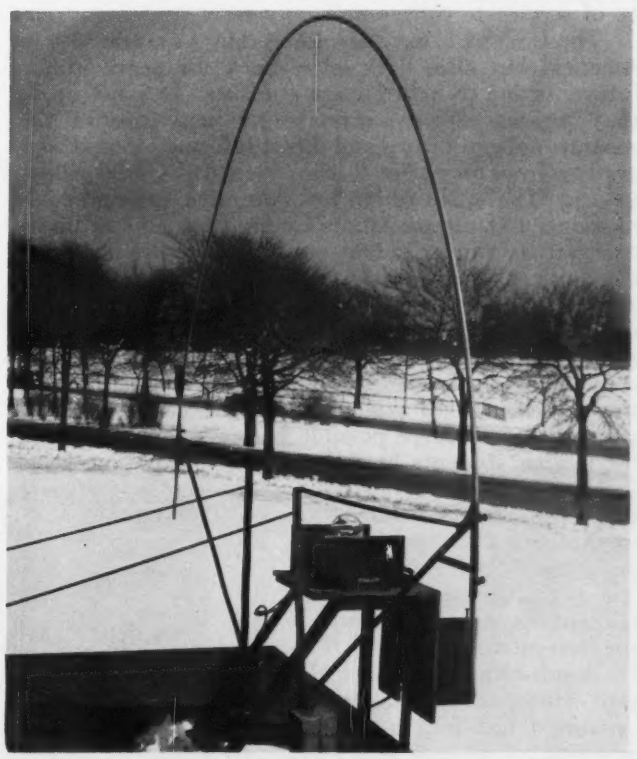
pletely heated by solar energy. The expense of such an installation, however, is prohibitive, while any smaller device would not have a sufficient heat storage capacity to last more than a day or two of cloudy weather. Therefore the heating of homes by storing heat in a liquid is, in general, impractical. Auxiliary units of this type have advantages, however, and should find some use. Besides aiding heating in the winter, they might be converted to air-conditioning units by placing a heat exchanger below the water level under the house or using a large scale heat engine. In the latter case, the sun's energy would be used to compress air which would then be allowed to expand in tanks where it would absorb internal heat. Here again, the main disadvantage is the high cost of installation.

In view of the above mentioned disadvantages, lately an entirely new system was devised, and it is with this that M. I. T. has been conducting its main research. Heat is stored by allowing the radiation from the sun to strike containers which hold chemicals that have a low melting point and high heat of fusion. Heat is reclaimed for other uses by passing air over the melted salts and so causing them to solidify and give up heat. The material which shows the most promise is Glauber's salt (sodium sulfate decahydrate) since it is cheap, melts at 90 degrees F., and has a relatively high heat of fusion. It is placed in glass containers which are black on the sunward side and white on those which face the interior. This new method of using chemicals to absorb and store heat is the result of research by Dr. Maria Telkes of the Institute and her patent application has been assigned to M. I. T.

The test building, located on Memorial Drive a third of a mile from the school, is a one-storied structure with roof and floor insulated by four inches of rock wool. Exterior walls on three sides are also insulated with the same material, while the fourth consists mainly of glass windows. The roof has overhang to help keep out the powerful rays of summer sunshine. There is no foundation or cellar, the structure resting on wood piers about two feet above the ground. The interior space is divided into seven cubicles with celotex walls, each one being a separate study or experiment with its own windows. Walls between are also well insulated so as to insure complete accuracy in results.

The object of dividing the interior is to concentrate seven years research into one. Each cubicle has different heat storage arrangements, although all are connected to master recorders in a room used as an office, and all have double glass on the side which faces the sun. Since the glass is not completely efficient in preventing heat from escaping, shades are provided to prevent losses at night and on sunless days.

The chemicals are stored in containers some of which resemble the familiar glass bricks used in architecture, and absorb the solar energy as soon as it goes through the glass. Two cubicles are provided with louvres or ducts with small fans to drive out the stored heat. Thermostats are used to control fan operation. Containers can be different sizes, according to predetermined ideas of how long the wall should store heat, and the chemical in them can be varied. On dull, chilly days an electric sunbowl is provided to keep the temperature at 70 degrees in the sections without sufficient stored heat and a record is kept of the power required. The outside wall is of the obscured or "figured" type



W. R. Stahl

A closeup of the pyroheliometer used to measure diffuse solar radiation. It is connected to a continuous recorder inside the building

of window glass because it transmits sunlight just as well as clear panes and is much cheaper.

Instruments continuously record a number of variables. The radiation from the sun is measured by a pyroheliometer and a micromax recorder kept in the office. Pyroheliometer operation is based upon the temperature differential between a silvered and a black disk as measured by a standard set of thermocouples. In order to prevent misleading results when measuring diffuse radiation, the disks are protected from the direct

(*Continued on page 310*)

the national student association at m. i. t.

Lawrence L. Lortscher, '51

"What is this organization called the NSA?" is a question asked by many college and university students who have heard of the things NSA has been doing for students. What these students have been hearing is nearly the answer. The NSA (National Student Association) is an organization of American university and college students whose purpose it is to develop unity and understanding among us who have the common purpose of acquiring an education.

From many colleges groups of students who were interested in developing some sort of unity among students of America and among students of the world sent representatives to a meeting at Madison last summer. It was there at Madison, Wisconsin, that the National Student Association was conceived in its present form. The NSA was not in any way conceived as a political party but designed as an organization to be of service to college and university students.

The USNSA is not only doing things for students in America, but also, with an outlook for peace in the future, trying to help foreign students. It is set up so that regional offices correlate the activities of the separate college groups and direct information and suggestions from the national office to the individual college groups. The organization has two main national commissions: a Domestic Affairs Commission and an International Relations Commission. The Domestic Affairs Commission directs activities to develop the unity of American students; it fosters such things as student clinics, cost of living surveys, etc. The International Affairs Commission in working toward a better understanding among students of the world is making possible the interchange of students between countries on a scale that was never possible before, sponsoring trips for foreign students in this country, conducting relief drives and carrying on many other projects. The following enumeration of the activities being carried on by the NSA committee at M.I.T. will best illustrate the things NSA is doing for American students and for foreign students.

A sub-committee called the Foreign Student Summer Project was organized last fall to develop and put into operation a plan for bringing eighty European students to M. I. T. for a summer session. The project is to be carried out at no cost to the foreign student. The Corporation of M. I. T. has cooperated by letting these students audit courses this summer tuition-free. Some of the fraternities here at M. I. T. are housing the students for the summer term. But it remains for the FSSP committee to raise funds to cover the expense of food and transportation.

The FSSP plan has the endorsement of Dr. Karl T. Compton and the United States State Department. The foreign students are to be selected on a basis of scholastic ability and leadership by the faculty of their own universities. Applications have already been sent to the foreign universities through the WSSF and the State Department.

The purpose of the project is to bring technical students to M. I. T. to introduce them to some of the recent technical developments, in order that they may return to their countries and go into science and industry with an added advantage and begin rebuilding their countries. The committee believes that expressions of international friendship such as this will help to instill a friendlier attitude among the people and the nations of the world.

Another of the many student services being performed by the NSA here at M. I. T. is the procurement of student ships for the summer of 1948. These student ships were used last year by American students going to Europe for the summer and by foreign students coming to the United States for summer studies. Students can, by traveling on student ships, cut transportation costs much below those on commercial lines. Since Congress was thinking of discontinuing the operation of student ships this year, the M. I. T. committee in conjunction with other NSA groups from all over the country wrote letters to the Congressmen concerned urging the passage of the Maritime Act. In addition M. I. T. committee members went to Washington to see what they could do to get the Maritime Act passed, so that the student ships would be available for the

WRUL short-wave broadcast to Europe explaining the Foreign Student Summer Project. Left to right: Lloyd Haines, Earl Eames, Dr. Compton, Norman Beecher, Donald Eberly *S. W. Plimpton*

Foreign Student Summer Project. The student ships will be available this summer; Congress has passed the Act.

Because of the pressing need for some type of faculty rating, the NSA decided to set up a Faculty Evaluation Committee and undertake this large, important enterprise. Although the actual evaluation has not yet officially commenced, it is scheduled to start as soon as the Student Faculty Committee approves the form which has been composed by the Faculty Evaluation Committee. Using this form or whatever form is eventually adopted, each honor society shall evaluate the professors in each of the respective courses; those courses not having honor societies shall be evaluated by the committee. When all the professors have been evaluated, the committee shall compile the data and distribute the results, which shall be confidential, to the professors. In addition to this work, the committee is embarking on a program of studying curricular reform. The members of the committee plan to send questionnaires to all men who graduated from M. I. T. five years ago. This group was picked as the most fertile source of constructive criticism as they have been out of school sufficiently long to know the relative utility of their courses, and yet they have not been out of school so long as not to be able to remember the context of the courses they have taken. It is the hope of the committee that all this will be accomplished prior to the completion of the present semester.

Foreign students who have come to this country for study have very few opportunities to see America and learn anything at all about the American way of life. The NSA has tried to increase the hospitality of people in communities around schools foreign students are attending. The committee at M. I. T. is planning a trip for foreign students to Niagara Falls during Easter vacation. During the last between-terms vacation two M. I. T. students took a group of eight of M. I. T.'s foreign students to Knoxville, Tennessee to see the TVA project. During the visit there they went to Oak Ridge. Foreign students can acquire a lot of information about America and Americans through such excursions as these.

Many schools have run into various problems concerning their student governments, which at times are not easily solved. Since M. I. T. has a very well organized student government, the New England regional office gave the committee at M. I. T. the responsibility of organizing student government clinics, in order that members from those schools with difficulties can bring up their problems and obtain suggestions for a suitable solution from other representatives whose student governments function without any trouble, at least from that particular difficulty.

The M. I. T. committee of NSA is obtaining copies of all the student government constitutions in the New England region and correlating the good points in each, so that any student government group that suddenly finds a problem arising can contact the M. I. T. committee and get suggestions for solving the problem. This activity has been of great value to some schools already.

A cost of living survey has been conducted here at Tech and the results sent to the regional office; the survey will be compared with surveys coming in from other colleges, and a report of the entire New England survey will be returned to each college. In cases where certain colleges have outstandingly high costs of living that group of students will immediately notice this from the report and can then set about to remedy the situation.

The United States Office of Education received sixty thousand letters from German students, who, having heard a Voice of America program suggesting that they write to Americans, wrote expressing a desire to engage in correspondence. The NSA here at M. I. T. has procured four thousand of these letters and distributed them here at M. I. T. to students interested in corresponding with Europeans. Students who have taken some of these letters and started correspondence have found that they can obtain information about the European countries and people that they otherwise would never have had the chance to learn.

American students are showing great interest once they realize what the NSA is. To summarize: It provides all students with an opportunity to do the type of work in which they are interested and to co-ordinate their activities with similar activities at other colleges. All students interested in any phase of student life, educational or relief work, national or international, may take part. The students participating in the committees at universities and colleges all over the country hope that the organization will continue to grow and provide even more services to students. It is an organization run by the students here in America, and it will increase in usefulness only if they work together toward making it a greater organization.

Vandenberg Challenge Links World Peace to

Foreign Students Free at MIT

By a Staff Photographer

A three-month course of study at Massachusetts Institute of Technology for 80 graduate students in devastated countries of Europe is being arranged by these members of a MIT student committee. Left to right are Norman Beecher, Chairman of the Foreign Student Summer Project; Lloyd Haynes and Earl Eames, founders, and Donald Eberly, in charge of publicity. The project is sponsored by the MIT unit of the National Student Association.

College Unit Maps Unique Plan

***Christian Science Monitor* gives front page space to the Foreign Students Summer Project**

# of and for the students

M. I. T.'s Student Government

John W. Weil, '48

At a recent convention of the Deans from a great number of American colleges a poll was taken to determine the degree of faculty control of the student governments in the various institutions. When the assembled Deans were finally asked which of them represented institutions whose student governments were entirely free from all faculty supervision, only two men answered affirmatively. Both of these men were from M. I. T.

A closely knit and entirely independent organization in its own right, the Massachusetts Institute of Technology Undergraduate Association has its headquarters in the Walker Memorial Building on Memorial Drive, just east of the Institute's main building. Here in this center of extra-curricular activity many of the various groups on campus hold meetings and have their offices. In the anteroom to Litchfield Lounge, the student government itself has a central office with a full-time secretary to handle some of the paper work and to lend a note of continuity to the entire organization. It is from here that the quiet controls of an efficient system extend out to every activity on campus.

At the head of the undergraduate government is the Institute Committee, guided by its six-man Executive Committee. Meeting every week or every other week, depending upon the need, the Institute Committee, with its total membership of about forty students, operates in the same manner as any other governing body. Presided over by the president of the senior class, the meetings are open to all who wish to witness the proceedings. No member of the faculty is ever present. The scope of the Institute Committee's powers is unlimited within the sphere of student activity, and although no definite honor system is in operation at Tech, there is strong sentiment at the present for placing the judicial power over the students in the hands of this body in addition to the already-present legislative and executive powers.

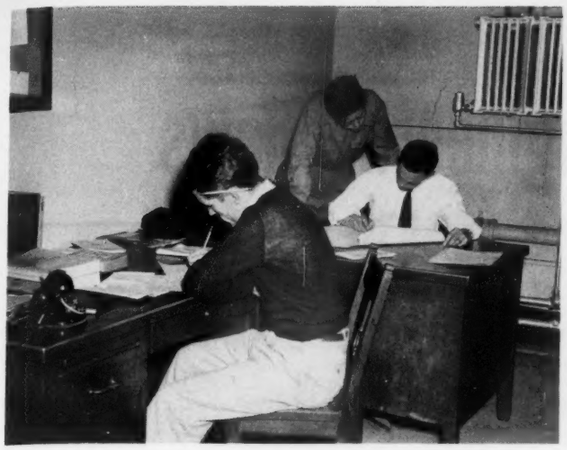
Immediately under the Institute Committee are the various permanent sub-committees which assist in carrying out many phases of the governmental activity and whose chairmen occupy seats on the Institute Committee. Most important of these sub-committees are the Walker Memorial Committee, the Budget Committee, the Student-Faculty Committee, and the Public Relations Committee. A service and regulatory organization, the Walker Memorial Committee has long been both the bane and blessing of many an activity leader's existence, for it is the clearing house for use of the M. I. T. facilities, including bulletin boards, offices, rooms for meetings and halls for dances. By keeping a file of the officers and constitutions of every activity — there are better than one hundred on campus — it is able to help organize and coordinate what would normally be a hopeless jungle of confusion and competition.

Myles Spector

Walker Memorial Committeemen discussing matters with their full-time secretary

Institute Committee in action: student self-government

Myles Spector



Myles Spector

***Tech Engineering News* staff members hard at work on the Open House (May) issue.**

The Budget Committee is the Institute Committee's independent treasury, whose funds are furnished from a small student tax taken from the tuition of every student. Administered by the Chairman of the Budget Committee, who is also the Treasurer of Institute Committee, this money provides a source of funds to many of the campus activities, as well as a safeguard for emergencies. The Student-Faculty Committee, on the other hand, is really a double committee, having both a student branch and a faculty branch. These two groups get together at regular intervals to discuss and work out problems having to do with academic difficulties and Institute policy. It is through this body that the student can get his complaint taken directly to the proper spot in the Administration.

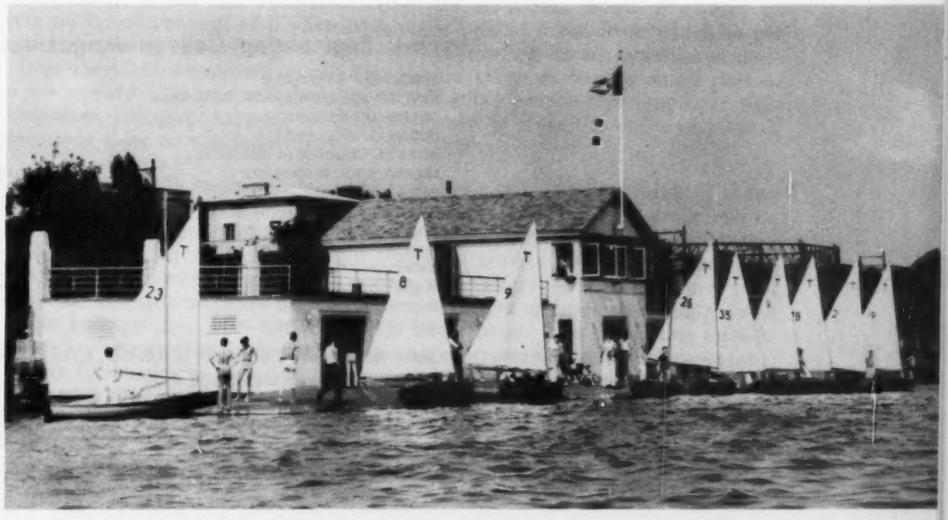
A much more recent experiment, the Public Relations Committee was set up to give the individual students and activities a publicity link with channels outside of M. I. T. Letters are sent by this committee to the home-town newspapers of every student who attracts attention because of noteworthy achievement or some special honor. In addition particular attention is given to events occurring in the undergraduate life in order to increase the public interest and goodwill towards the undergraduates at the Institute.

Comprising the rest of the Institute Committee proper are the representatives of the four undergraduate classes and of the so-called class "A" activities. These latter activities are the organized groups on campus whose scope of action and membership make them of interest to the entire student body and therefore entitle them to active participation in the government. This group of activities would include such things as the publications — like the TECH ENGINEERING NEWS; the Athletic Association — one of the country's few student-run athletic regulatory bodies — which controls both the intramural and intercollegiate sports programs, and the Outing Club — the campus group sponsoring most of the energetic activities such as skiing, square dancing, and hiking. Several other examples of class "A" activities would be the Tech Show — the yearly, campus-wide dramatic production, the Nautical Association — which operates the Sailing Pavilion on the Charles River directly in front of the main Institute building, the Dormitory Committee, the Interfraternity Conference, and the 5:15 Club — representing respectively the governing bodies of the three residential groups, the dormitories, the fraternities, and the commuters. With the possible exception of the presence of various Alumni Advisory Committees, these class "A" activities are all entirely student run and managed.

However, by far the most numerous category of organization is that of class "B" activity. This classification covers all other organizations on campus which are recognized by the Institute Committee and which are thus able to use the Institute facilities and become an integral part of the extra-curricular structure. Recognition by the Institute Committee has been easy to obtain in the case of a class "B" organization since it has long been policy to allow any group of students with common interests to band together in a formal organization whenever they so desired, subject only to the regulation of having to draw up an acceptable constitution and being financially sound in the eyes of the Budget Committee chairman.

In this varied group of organizations are such activities as the religious organizations, for example the Catholic Club and the Hillel Society, nationalistic groups such as the Hellenic Society and the Chinese Students Club, hobby groups such as the Tech Model Aircrafters, Tech Flying Club, and the Model Railroad Club, the student branches of the numerous professional societies such as the American Society of Mechanical Engineers and the American Institute of Electrical Engineers, and honorary societies such as Tau Beta Pi, the general engineering honorary fraternity. Each of these organizations functions independently except where it must of necessity come into contact with other organizations and other external facilities, in which case its membership in the Undergraduate Association

(*Continued on page 314*)



Breezy interlude for Tech men on a hot spring day provided by the Nautical Association's fleet of forty-odd dinghies and four "110"s

the tech engineering news

Professional Journal of the Undergraduates of the
Massachusetts Institute of Technology

Managing Board

EDWARD M. KOSOWER, '49 . . . . . General Manager
EDWARD T. MILLER, '49 . . . . . Editor-in-Chief
GUIDO J. FRASSINELLI, '48 . . . . . Managing Editor
WILLIAM R. BOHLMAN, '49 . . . . . Business Manager

Junior Board

EDWARD A. MULLERY, '48 . . . . . Advertising Manager
CHARLES M. JORDAN, '49 . . . . . Art
ROY JENKINS, '50 . . . . . Make-Up
MARIO DIQUILIO, '48 . . . . . Circulation Manager
JAMES BUCK, '49 . . . . . Sales
HARRISON C. WHITE, '50 . . . . . Literary Editor
RALPH JOHNSTON, '50 . . . . . Literary Associate

Staff

CLARK ABT, '51
RICHARD AHEARN, '50
MARC L. ALFANDRY, '51
FRED BERGMANN, '50
FRED DIAMOND, '50
STANLEY FLEISIG, '50
LOUIS GALAN, '51
CLARENCE GREGORY, '51
WERNER H. GUMPERTZ, '48
JOSEPH HODNICK, '51
KENNETH KOPPLE, '51
PETER M. LANG, '51
LAWRENCE LORTSCHER, '51
JERRY LEVINE, '51
IRWIN MANNING, '51
EMERINO MARCHETTI, '51
FRANCIS B. MCKEE, '51
CHARLES MILLER '51
ROBERT J. MUZZEY, '50
MARK NELKIN, '51
PETER NEY, '51
LEONARD NIPPE, '50
WILLIAM PRICE, '50
LEO SARTORI, '50
CHARLES K. SHRAMM, '51
HARRY F. SMITH, JR., '51
MYLES SPECTOR, '50
WALTER STAHL, '51
STUART STEIN, '51
DAN SULLY, '51
ROBERT VIDAL, '49
HELMUT WEBER, '50
ROBERT B. WOLF, '50

Member Engineering College Magazines Associated

ARKANSAS ENGINEER
CINCINNATI COOPERATE ENGINEER
COLORADO ENGINEER
CORNELL ENGINEER
DREXEL TECHNICAL JOURNAL
ILLINOIS TECHNOGRAPH
IOWA ENGINEER
IOWA TRANSIT
KANSAS ENGINEER
KANSAS STATE ENGINEER
KENTUCKY ENGINEER
MARQUETTE ENGINEER
MICHIGAN TECHNIC
MINNESOTA TECHNO-LOG
MISSOURI SHAMROCK
NEBRASKA BLUEPRINT
NEW YORK UNIVERSITY QUADRANGLE
NORTH DAKOTA ENGINEER
OHIO STATE ENGINEER
OKLAHOMA STATE ENGINEER
PENNSYLVANIA TRIANGLE
PENN STATE ENGINEER
PURDUE ENGINEER
ROCHESTER INDICATOR
ROSE TECHNIC
TECH ENGINEERING NEWS
WAYNE UNIVERSITY ENGINEER
WISCONSIN ENGINEER

JOHN A. HENRY, University of Illinois, Urbana, Illinois — Chairman
LITTELL MURRAY BARNHILL, INC. — Publisher's Representative
101 Park Avenue, New York
605 North Michigan Avenue, Chicago

the dragon's den

What's Going On?

How much do you know about M. I. T.? We are all aware that its interests and activities extend far beyond a few students in one of two engineering courses. Open House day is held by the Institute to better acquaint the public with what is happening within and also in the shadow of its granite walls. This gives rise to the question whether we who are right here on campus nearly the year around are aware of much that is taking place. Maybe we could well afford to join the parties that are being conducted around the campus. But when you come right down to it, we can take such a trip every day, and yet how many of us ever do?

There are many interesting things going on around M. I. T., and it might be quite profitable to us if we knew more about them. There are numerous items which never get mentioned in *The Tech* or in the weekly calendar of events, but an alert student can still learn of many of them. In general it pays to be aware of what is going on around you. Here at M. I. T., where so much is happening, it pays all the more.

Individual Slide Rule Jockeys

One of the things the Techman at times most regrets and yet usually feels quite proud of is the amount of academic work he has to do. The matter of the individual student's independence is perhaps prided equally as highly. However, this independence is only of value in relation to what he does with it. In most cases the student is not looked after closely and told what to do. Of course, studies are usually designed to take a large part of the time not spent in classes or labs. Yet, there is reason to consider how we use what little time we have to spare, especially since we are on our own to such an extent.

At many other schools, though the student may not actually be directed as to what he should do, there is such an overwhelming sentiment for each student to join with the rest of the school in some activity (usually backing a team) that effectively the student becomes part of something larger than himself. Fortunately, here at Tech, the sports facilities are for the benefit of all who really desire to participate, and catering to fans is not a major item on the athletic program.

Nevertheless, this letting each student go his own way may have good or bad effects, and it is up to the student to see that he benefits from the situation. Some of us may go through Tech with no larger concept of it than as a place to study and from which to get a degree. However, the value of this degree may vary, depending on what we have done with our time. Organized extra-curricular activities should claim at least a small part of that time. It is not merely that you will be able to tell some prospective employer that you were this or that on campus. Instead we might consider it from the point of view of what such participation does to the individual.

In the first place M. I. T. is large and fairly impersonal. It is hard to think of many ways to identify yourself more closely to it than just as a student doing his assignments. It really in itself affords little opportunity to get the feeling of being a part of something larger than yourself. But the myriad of organized activities around the campus does give every one a chance to join something and work together with others for some common goal. This is not to exhort all the student body to become great joiners or to come rushing down to the *T. E. N.* office and sign up. It is rather to urge them to get into something outside of themselves and work. The number of organizations you are a member of is not important, but rather the extent to which you actively participate in any one. There are numerous reasons for joining in with other students to make your free hours more pleasant. Experience of others would show that they make your school days more memorable and more fully appreciated as time goes on. They also help develop a personality and an attitude which facilitates your success, whether as an engineer or a scientist.

E. T. M.

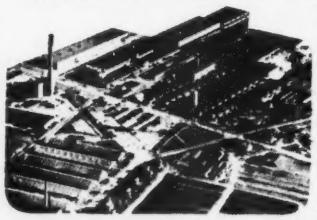
LUFKIN
LUFKIN
Built to stand up to the toughest treatment. Special steel line has "Nubian" finish—dead black background with markings cut deeply into bright portions for maximum reading ease and accuracy. Easily detached from husky metal reel. Write for free catalog. THE LUFKIN RULE CO., SAGINAW, MICHIGAN, New York City.
LUFKIN
FOR DURABILITY

Refrigerated Trucks Loading Frozen Foods.

World's Largest Quick-freezer Uses

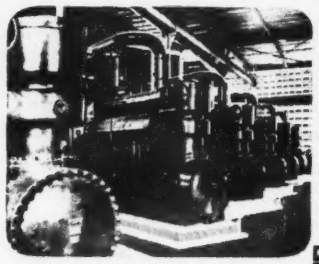
FRICK Refrigeration

Seabrook Farms—Deerfield Packing Corp. are breaking all records for quick-freezing foods at their gigantic plant near Bridgeton, N. J. They are processing as much as a million pounds of vegetables and fruits a day, 85% of which are promptly frozen.



Air View of the Great Plant near Bridgeton, N. J.

Their precooling, quick-freezing and cold storage operations are all handled with Frick Refrigeration. Storage capacity is over 50 million pounds. Twelve big Frick ammonia compressors, driven by motors totaling 3825 horsepower, carry the cooling load with dependability.



Six of Nine Frick 4-Cyl. Amm. Compressors.

● **The Frick Graduate Training Course in Refrigeration and Air Conditioning now in its 31st year is approved under the G.I. Bill of Rights.**

DEPENDABLE REFRIGERATION SINCE 1887
FRICK CO.
WAYNESBORO PENNA. U.S.A.

the future of m. i. t.

(*Continued from page 281*)

at the top of the list of responsible student governments will be strengthened.

Extra-Curricular Activities

This last year we have witnessed under the direction of Professor Klaus Liepmann a remarkable increase in interest and participation in music. This is a beginning and is indicative of what the future may hold for possible development of other extra-professional interests. We should, when it becomes financially possible, provide similar opportunity for all our students in creative art.

The development of our athletic program, both intercollegiate and intramural, is already growing at a very rapid pace under the direction of Mr. Ivan Geiger. With the establishment of a varsity baseball team this spring the M. I. T. Student Athletic Association sponsors every intercollegiate sport except football. Experts within our student body disagree as to whether or not we should have a varsity football team. Most authorities in the realm of intercollegiate athletics advise that we are fortunate not to be subject to the increasing problems associated with this sport. Unless there are drastic changes in our total educational program there appears to be little chance that varsity football will ever find a place at M. I. T.

The future will more likely see a greatly increased participation in intramural athletics and in the sports of carry-over value which have long been established and which do not demand the expenditure of time and money required by football to produce teams capable of intercollegiate competition.

Our new program of required athletics for freshmen in which all students in their first year have opportunity to learn to participate in and enjoy at least two or three sports should be a strong influence in increasing athletic activity.

These future developments we see now in beginning stages. There are others. Our students of tomorrow will desire ever-increasing opportunities to keep informed concerning the issues of their time beyond the reach of their particular scientific or engineering specialties. They will be concerned for world affairs, economics, sociology, politics, philosophy, art, psychology and religion.

Within the limits of a four or even five year program it will not be possible to provide the type of curricular studies that will introduce our students to an understanding of these fields of man's enterprise. But they will realize the importance of wisdom in realms beyond their professional specialization and so there will be, in the future, a growing pressure for more and more extra-curricular special lectures, seminars, library exhibits, and group discussions to satisfy the need for the development of a philosophy of life adequate for the responsibilities of citizenship in tomorrow's world.

M. I. T. of tomorrow will always stand among the foremost colleges and universities of the world. Its academic standards shall never be lowered. The environmental influences upon the lives of its students and Faculty resulting from new dormitories, an adequate library, greatly improved playing fields and recreational facilities, increased autonomy and responsibility of student government and a greater emphasis on extra-curricular liberal arts will tend to make the graduates of M. I. T. even more competent in their professional fields. They shall with the gaining of knowledge acquire even greater wisdom and understanding.

Is that "HER" voice?

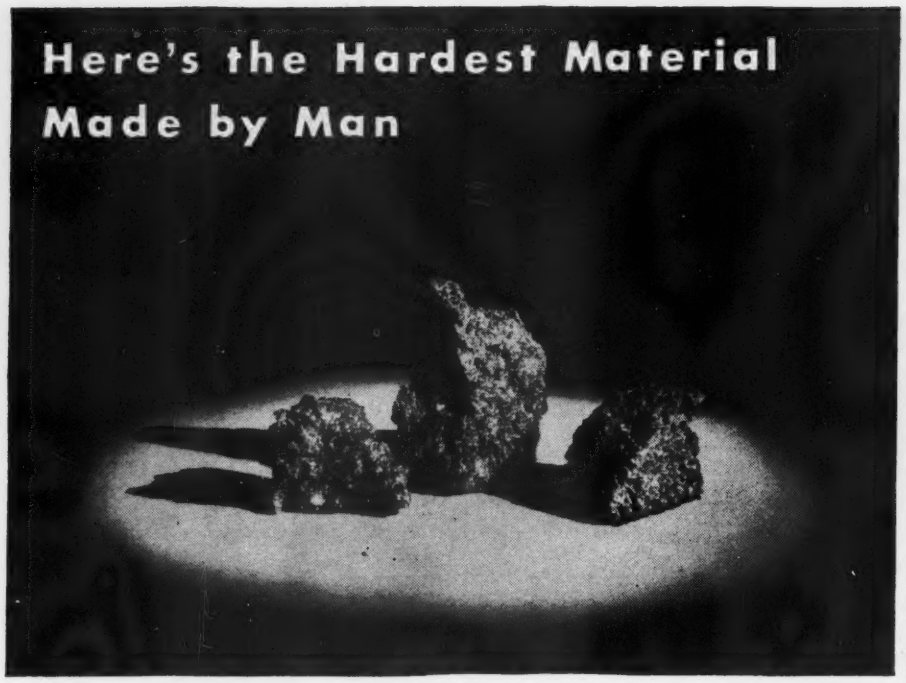
Yes, indeed. That figure 1 up there, with hundreds of zeros trailing after it, represents the number of times "her" voice is amplified when she telephones you from across the country. Even on shorter calls, the total is tremendous.

The reason is that circuit resistance reduces the current which carries the voice. So every few miles vacuum tube repeaters refresh it by boosting its power as much as a million times.

The task of preparing new pathways for the voice occupies many qualified engineers. Tubes and amplifiers must be designed. Cable and intricate mechanisms must be produced. The lines themselves must be extended—over mountains and prairies, under rivers and through city streets—wherever the voice must travel.

Engineers who have a part in this job know there's a future in telephony.

BELL TELEPHONE SYSTEM



It's NORBIDE*. . .

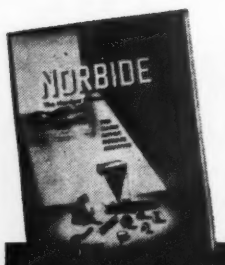
A Norton development that's mighty useful to industry

A product of Norton research, its unique characteristics make it very helpful in three entirely different ways —as an **abrasive** for lapping superhard materials—in **molded form** where extreme resistance to wear is desired—or for **metallurgical** use as an alloying agent.

Norbide is the trade-mark for Norton Boron Carbide, a material produced by fusing two commonplace materials, boric acid and petroleum coke, in the electric furnace at terrific temperatures. It is harder than any material except the diamond.

Not only is Norbide* extremely useful as an abrasive but because it is self-bonding under high pressure at high temperatures, it can be molded into a variety of products that are finding wide application for their exceptional resistance to wear and other unique properties.

The fascinating story *of Norbide products and their many interesting applications is described in catalog 378-CP. Every engineering student will want a copy. Write today —no obligation.*



NORTON COMPANY, WORCESTER 6, MASS.
Behr-Manning, Troy, N. Y. is a Norton Division

*Registered trade-mark for Norton Boron Carbide

NORTON

ABRASIVES — GRINDING WHEELS — GRINDING AND LAPPING MACHINES
REFRACTORIES — POROUS MEDIUMS — NON-SLIP FLOORS — NORBIDE PRODUCTS
LABELING MACHINES BEHR MANNING DIVISION COATED ABRASIVES AND SHARPENING STONES

the past

(*Continued from page 283*)

(Building 17) and the new Rogers Building (Building 7) in 1938. Occupation of the new Rogers Building marked the formal completion of the move from the old location, which in 1938 became the property of the New England Mutual Life Insurance Company and now is the site of the New England Mutual Building.

Walker Memorial, student activity center, was finished in 1917 through the contributions of the rank and file of the alumni. The President's House was ready for occupancy in 1916; and 1917, 1924, 1927, and 1930 marked the erection, respectively, of the old Senior House and the various units of the undergraduate dormitories. The purchase of the Bexley Hall Apartments and the Riverbank Hotel and the conversion of the latter into the Graduate House was made in 1938.

In addition to these structures, the Barbour Field House, the Sailing Pavilion, the Briggs Field House, and the Alumni Swimming Pool were completed in 1934, 1936, 1939, and 1940. The latter is one of the finest collegiate pools in the East.

Yet this growth is continuing still. A new Senior House is even now in the process of erection, and the Charles Hayden Memorial Library will soon be started. Besides these, many other structures both temporary and permanent were put up to house the gigantic research program conducted here during the recent war.

These wartime units have now been entirely reconverted to regular research. It is difficult to realize how immense must have been the effort in effecting this change, for M. I. T. was at the height of the conflict the center of a great many wartime activities. Had one of these projects, the Radar and Radiation Laboratory, failed, Technology would have foundered heavily both as regards reputation and finances. Happily, these efforts were concluded commendably; and a peace-time school is once again about its business of providing educations for peace-time engineers and scientists.

Weighing the contribution that this institution has made to the world of education, one finds that it is very large indeed. Technology was not, however, the first school to meet the needs of the Industrial

(*Continued on page 300*)

RCA scientists—pioneers in radio-electronics—apply the "radio tube" to communications, science, industry, entertainment, and transportation.

This "magic lamp" makes Aladdin's look lazy

You will remember the fabulous lamp—and how it served its master, Aladdin. Serving you, today, is a real "magic lamp" . . . the electron tube.

You are familiar with these tubes in your radio, Victrola radio-phonograph or television set . . . but that is only a small part of the work they do. Using radio tubes, RCA Laboratories have helped to develop many new servants for man.

A partial list includes: all-electronic television, FM radio, portable radios, the electron microscope, radio-heat, radar, Shoran, Teleran, and countless special "tools" for science, communications and commerce.

The electron microscope, helping in the fight against disease, magnifies bacteria more than 100,000 diameters, radar sees through fog and darkness, all-electronic television shows events taking place at a distance, radio-heat "glues" wood or plastics, Shoran locates points on the earth's surface with unbelievable accuracy, Teleran adds to the safety of air travel.

Constant advances in radio-electronics are a major objective at RCA Laboratories. Fully developed, these progressive developments are part of the instruments bearing the name RCA, or RCA Victor.

• • •

When in Radio City, New York, be sure to see the radio, television and electronic wonders at RCA Exhibition Hall, 36 West 49th Street. Free admission. *Radio Corp. of America, RCA Building, Radio City, N. Y. 20.*

Continue your education with pay—at RCA

Graduate Electrical Engineers: RCA Victor—one of the world's foremost manufacturers of radio and electronic products—offers you opportunity to gain valuable, well-rounded training and experience at a good salary with opportunities for advancement. Here are only five of the many projects which offer unusual promise:

- Development and design of radio receivers (including broadcast, short wave and FM circuits, television, and phonograph combinations).
- Advanced development and design of AM and FM broadcast transmitters, R-F induction heating, mobile communications equipment, relay systems.
- Design of component parts such as coils, loudspeakers, capacitors.
- Development and design of new recording and reproducing methods.
- Design of receiving, power, cathode ray, gas and photo tubes.

Write today to National Recruiting Division, RCA Victor, Camden, New Jersey.

Also many opportunities for Mechanical and Chemical Engineers and Physicists.

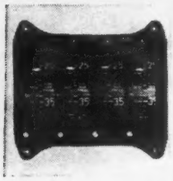
RADIO CORPORATION of AMERICA

means wasted fuel

The designing engineer, the mechanic and the pilot, all find Cambridge Exhaust Gas Analysers essential for developing, adjusting and operating internal combustion engines. These instruments make available continuous indication of air-fuel ratio of the mixture being supplied to the engine.

exhaust gas tester

determines the completeness of combustion in one or all cylinders. This rugged and accurate instrument is conveniently portable for field and shop use.



aero mixture indicator

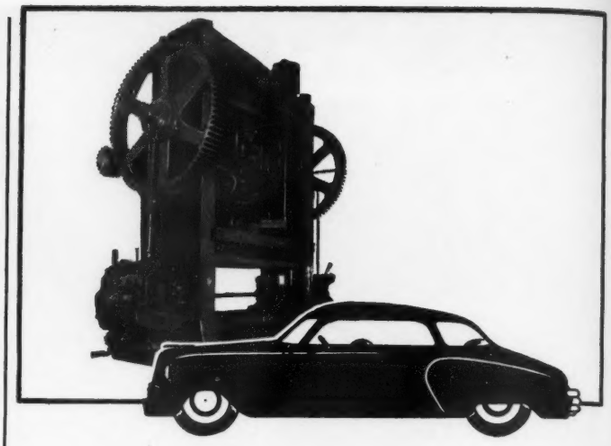
is a flight instrument for installation in single or multi-engine planes. Its use makes possible greater pay load, cruising radius and safety.

Send for literature

CAMBRIDGE INSTRUMENT CO., Inc.

3756 Grand Central Terminal, New York 17, N. Y.

PIONEER MANUFACTURERS OF PRECISION INSTRUMENTS



BEHIND IT...A *LITTELL FEED*

Automobiles are beautifully made, surprisingly low in cost. "Behind" the automobile you will find modern Littell Feeds that handle ten ton coils of ribbon steel, making possible automatic stamping and "nesting" of fenders, hood tops, knee action parts and other components, an important factor in economical automobile fabrication.

LITTELL

F. J. LITTELL MACHINE CO.

4127 RAVENSWOOD AVENUE • CHICAGO 13, ILLINOIS

the past

(*Continued from page 298*)

Revolution: Rensselaer Polytechnic Institute was founded in 1824 for the instruction of civil engineers, and scientific schools were established at Harvard and Yale Universities in the early 1800's.

An integral part of William Barton Rogers' dream, however, was the laboratory method. He firmly believed in the principle of having pupil and teacher work side by side to verify wherever possible the facts presented in the lecture hall. By instilling in the student the proper conception of the nature and methods of investigation, by teaching him to be observant, discriminating and exact as well as informed, he did away with a faulty but hallowed system. Soon after its inception at M. I. T., this novel technique began to replace elsewhere the idea of having great numbers of students sit in a vast lecture hall to hear and accept without question the speech of an impersonal being in the front of the auditorium.

Among other firsts at the Institute was the principle that an engineer should receive training in the field of economics. Moreover, the modern profession of chemical engineering was virtually created at Technology; and its courses of instruction in electrical engineering, in aeronautical engineering, and in applied physics were probably the first in the world.

Dr. Compton has successfully guided the Institute through its war effort. Now he faces the task of leading the Institute in peace-time and nurturing its pioneer-spirit as manifested in its previous achievements. President Rogers' dream is ensured and vindicated for all time.

open house

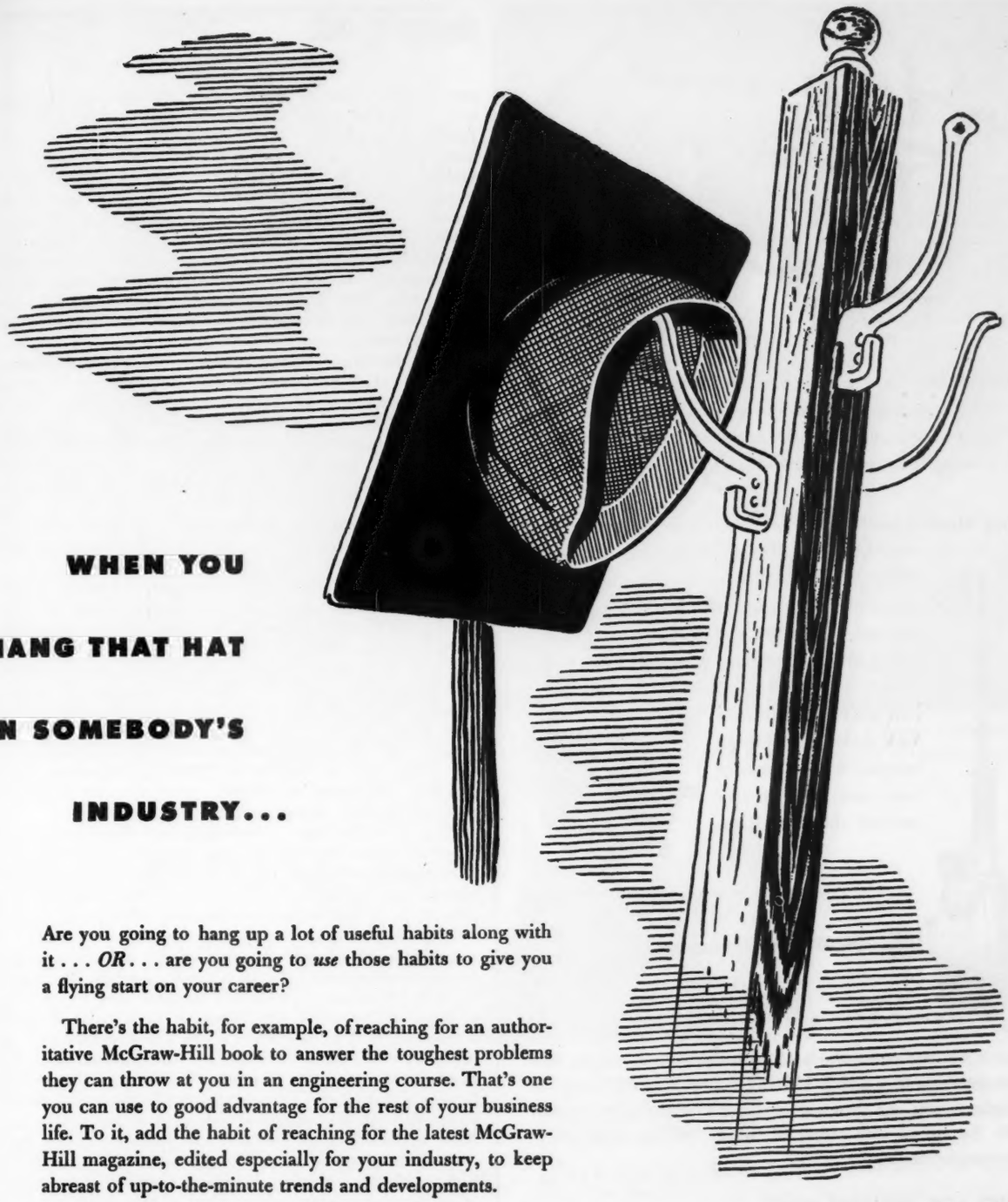
(*Continued from page 286*)

program sponsored by the Institute. The emphasis here is on participation rather than competition. Feeling that physical fitness is essential to mental alertness, participation in all types of athletics is encouraged. Inter-collegiate teams compete in almost all sports, including hockey, crew, swimming, tennis, squash, lacrosse, basketball, track, cross-country, fencing, golf, soccer, baseball, and others. Scheduled for Open House day are several athletic events including crew races, a track meet, a tennis match, and a swimming exhibition. Tech athletes will be competing with other Eastern schools.

The M. I. T. Nautical Association boasts the largest collegiate fleet of sailboats in the country. Featuring intra-mural and inter-collegiate racing, the Nautical Association offers the relaxing sport of sailing to all Technology personnel. The sailing pavilion on Memorial Drive will be open with exhibitions of the equipment and training methods used.

There are many other phases of student activities which will be exhibited and demonstrated. For instance: activities like the Institute Committee, undergraduate governing body, the Technology Christian Association, student service organization, and the undergraduate publications, which give the students an opportunity to gain experience in organization and administration.

It is impossible to present the complete scope of Open House. Only a small part of the multitude of exhibits have been mentioned here. Representing thousands of people living and working together, Open House presents Technology, 1948.



WHEN YOU HANG THAT HAT IN SOMEBODY'S INDUSTRY...

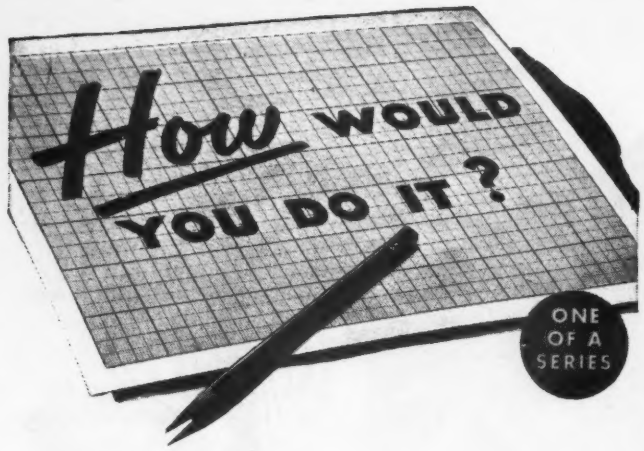
Are you going to hang up a lot of useful habits along with it . . . *OR* . . . are you going to *use* those habits to give you a flying start on your career?

There's the habit, for example, of reaching for an authoritative McGraw-Hill book to answer the toughest problems they can throw at you in an engineering course. That's one you can use to good advantage for the rest of your business life. To it, add the habit of reaching for the latest McGraw-Hill magazine, edited especially for your industry, to keep abreast of up-to-the-minute trends and developments.

For years, the keenest technical minds in industry have funneled their best thinking into McGraw-Hill books and magazines, building up a reservoir of useful information larger than any one business could ever acquire for itself. That's why McGraw-Hill is known as "Headquarters for Industrial Information."

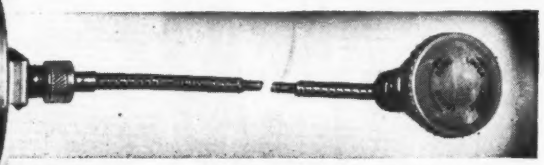
It will pay you to keep the McGraw-Hill habit.

McGRAW-HILL
PUBLICATIONS
HEADQUARTERS FOR INDUSTRIAL INFORMATION
330 WEST 42nd STREET • NEW YORK 18, NEW YORK



PROBLEM—You are designing a telescoping radio antenna for automobiles. You want to provide a means for extending and retracting the antenna sections from a convenient point inside the car. How would you do it?

THE SIMPLE ANSWER—The illustrations show how one manufacturer did it—with two S.S.WHITE FLEXIBLE SHAFTS. One shaft, operated from the control knob, turns a reel at the base of the antenna. The other, on the reel, pushes up and pulls down the antenna sections as the reel is turned. As S.S.WHITE shafts can be supplied in any length, this arrangement makes the antenna adaptable to all types of cars and other motor control shaft vehicles.



Photos courtesy of L. S. Brach Mfg. Corp., Newark, N. J.

This is just one of hundreds of power drive and remote control problems to which S.S.WHITE FLEXIBLE SHAFTS are the simple answer. All engineers will find it helpful to be familiar with the range and scope of these "METAL MUSCLES"* for mechanical bodies.

*Trade Mark Reg. U.S. Pat. Off. and elsewhere

SEND FOR BULLETIN 4501

It gives basic information and engineering data about flexible shafts and their many uses. We'll gladly send you a free copy on request.

S.S.WHITE INDUSTRIAL DIVISION
THE S. S. WHITE DENTAL MFG. CO.
DEPT. C, 10 EAST 40th ST., NEW YORK 16, N. Y.
FLEXIBLE SHAFTS • FLEXIBLE SHAFT TOOLS • AIRCRAFT ACCESSORIES
SMALL CUTTING AND GRINDING TOOLS • SPECIAL FORMULA RUBBERS
MOLDED RESISTORS • PLASTIC SPECIALTIES • CONTRACT PLASTICS MOLDING
One of America's AAAA Industrial Enterprises

physics at tech

(*Continued from page 287*)

rest of the atom. Unfortunately, the cosmic rays, the only available particles of such high energy, are very feeble in intensity, and are mostly stopped by the atmosphere; experiments must be made at high altitudes, and even then one must wait some time before a particle comes along. Artificial production of the mesons in the laboratory would make their study much easier. The first machine to make mesons artificially was the great cyclotron at the University of California at Berkeley, where the result was announced a few weeks ago. The Institute synchrotron should be operating soon, and should be the second or third machine to make them.

The Institute thinks about even larger machines: Institute staff members at the Brookhaven National Laboratory are designing a machine to reach 2.5 billion volts, and when it is built, it too will be available for graduate students. In the meantime the department's cosmic ray group studies these same particles in cosmic rays, at high altitudes, in the mountains, in airplane flights, and by means of balloons, which have reached heights of 100,000 feet. Thus we are contributing to the knowledge of nuclear physics, the most exciting and most rapidly developing field of physics today.

Another subject in the third year of Course VIII is electronics. Electrons can be emitted from hot filaments; this is the basis of the ordinary vacuum tube used in radio. They can also be emitted from cold surfaces, if light falls on them; this is the basis of photocells. Principles of these and related subjects are studied in the junior and senior laboratories. But the subject goes much further than this, for electronic circuits and devices have become so common and so useful that they are now used in almost all sorts of experiments in physics. Without electronic methods, for instance, modern nuclear physics would be impossible.

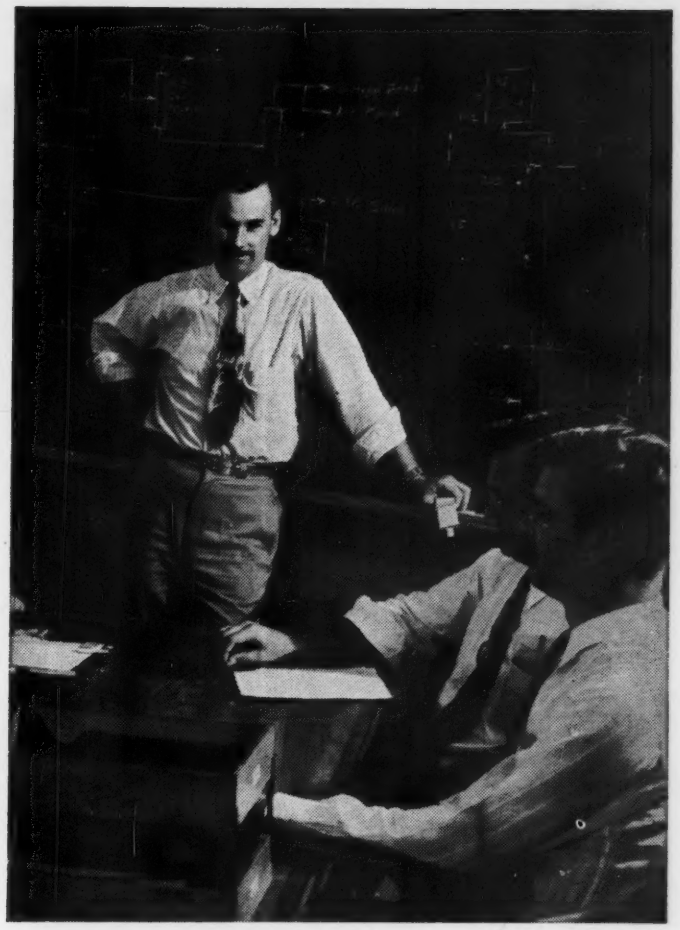
Some of the more interesting new developments of electronics are the field of the Research Laboratory of Electronics, another of the Institute's interdepartmental laboratories. This is partly the outgrowth of the M. I. T. Radiation Laboratory, which was located on the M. I. T. campus during the war, though it was a government laboratory, and which led the research on microwave radar during the war. Largely as a result of that laboratory, physicists learned how to generate and use microwaves: electromagnetic or radio waves of wave-length of a few inches. Now the Electronics Laboratory, controlled entirely by the Institute, makes available to students the best facilities in the field to be found anywhere. The program of research deals not so much with the practical side of microwaves as with their application to fundamental physics. They form part of the electromagnetic spectrum, between ordinary radio and the infrared, in which there is a great deal of interesting spectroscopy. Part of this relates to what is called hyperfine structure, in which there is a particularly close relationship both with ordinary spectroscopy and with nuclear structure. Other applications of microwaves are of a more practical sort, as for instance the construction of a linear accelerator, a device for accelerating electrons by microwave means, somewhat similar to a synchrotron, but with different methods.

Still another third year subject is thermodynamics and kinetic theory. The undergraduate laboratories do not have much work in the field, though much of electronics involves kinetic theory. But in the Research

(*Continued on page 306*)

SALLY CHERRY, one of the laboratory experts who keep Esso Products high in quality.

JOHN BRITTON, Esso Heating Oil Clerk makes up delivery schedules from card index of customer needs.



W. D. BEISNER, University of Minnesota '46, **C. T. STEELE,** University of Missouri '38, **R. S. PENDEXTER,** V. P. I. '41, confer on trouble phases of refinery operation.

Good PEOPLE are Good BUSINESS!

WILBUR HUNT, Pittsburgh '42 and **D. F. EATON,** Iowa State '34 discuss Wax Plant operations.

Salesman...lab expert...office boy or president—every one of our workers knows he has a wide open chance to keep on getting ahead in the company!...

Because every president of our company has worked his way up!

Over 30 years ago, our company set out to develop, with its employees, the best possible program of benefits for its workers.

Today our workers get exceptionally good wages and exceptionally steady work. Retirement on pension at 65. Vacations with pay. Special benefits in case of accidents, sickness or death. Company training for advancement to better jobs.

Some results?...Well, no important strike or labor disturbance in over 30 years, for instance. A staff of some 28,000 workers who bring to their jobs each day an average of over 14 years' service with the company —2,000 of them over 30 years!

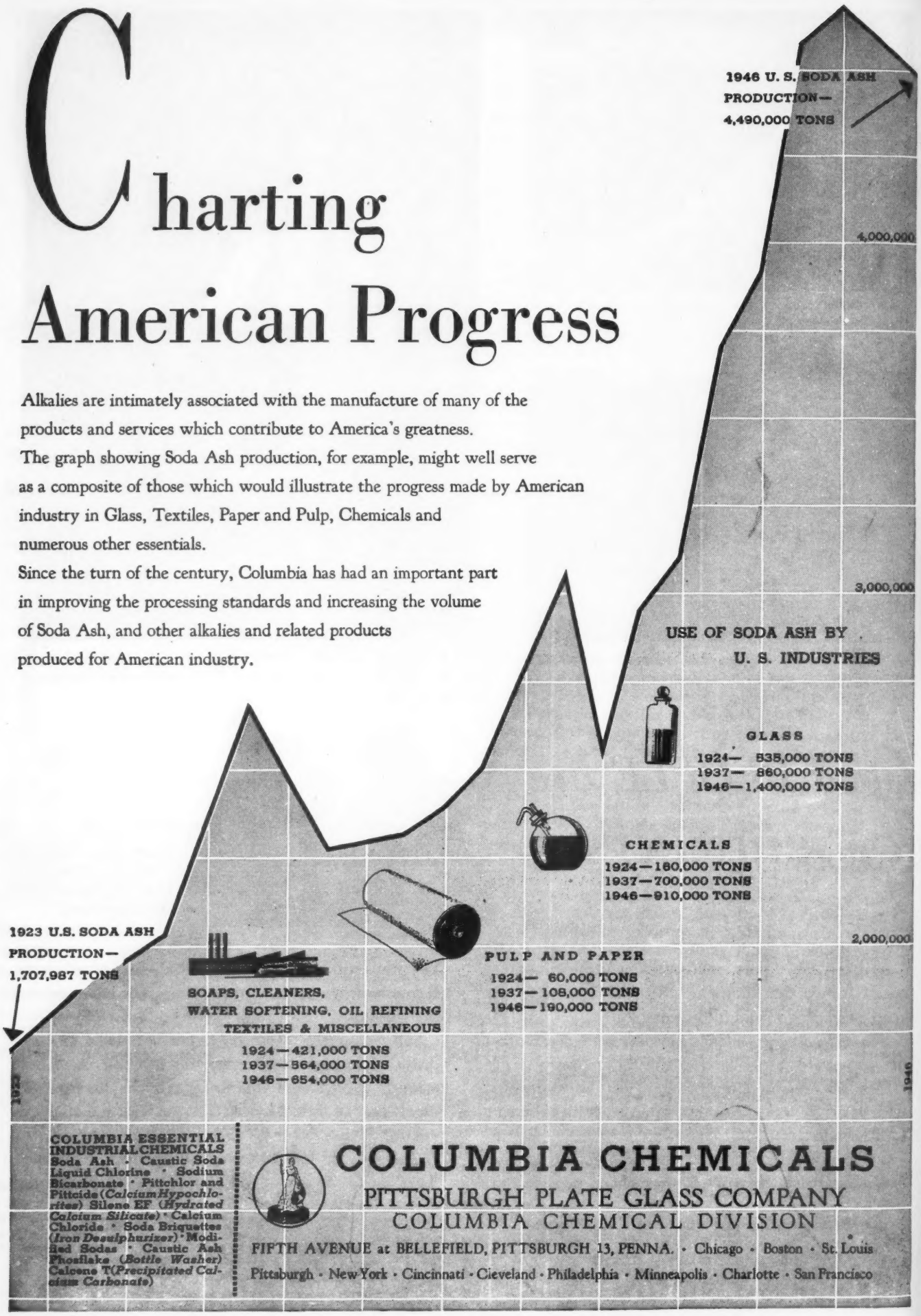
This means a lot in a technical, competitive business. That's why we say—good *people* are good *business!*

ESSO STANDARD OIL COMPANY

Charting American Progress

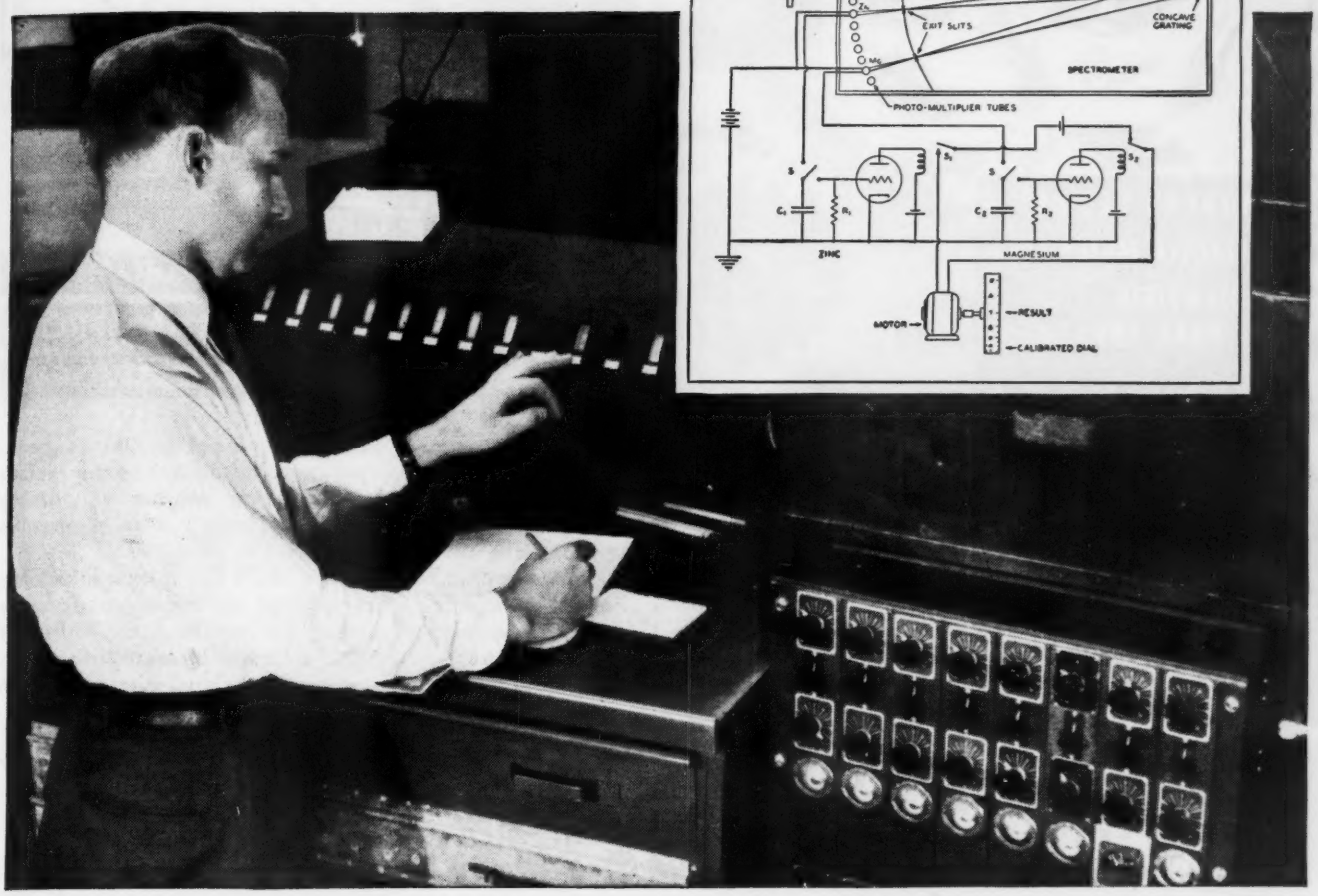
Alkalies are intimately associated with the manufacture of many of the products and services which contribute to America's greatness. The graph showing Soda Ash production, for example, might well serve as a composite of those which would illustrate the progress made by American industry in Glass, Textiles, Paper and Pulp, Chemicals and numerous other essentials.

Since the turn of the century, Columbia has had an important part in improving the processing standards and increasing the volume of Soda Ash, and other alkalies and related products produced for American industry.



COLUMBIA ESSENTIAL INDUSTRIAL CHEMICALS
Soda Ash · Caustic Soda Liquid Chlorine · Sodium Bicarbonate · Pittchlor and Pittcide (*Calcium Hypochlorites*) Silene EF (*Hydrated Calcium Silicate*) · Calcium Chloride · Soda Briquettes (*Iron Desulphurizer*) · Modified Sodas · Caustic Ash Phosflake (*Bottle Washer*) Calcene T (*Precipitated Calcium Carbonate*)

COLUMBIA CHEMICALS
PITTSBURGH PLATE GLASS COMPANY
COLUMBIA CHEMICAL DIVISION
FIFTH AVENUE at BELLEFIELD, PITTSBURGH 13, PENNA. · Chicago · Boston · St. Louis
Pittsburgh · New York · Cincinnati · Cleveland · Philadelphia · Minneapolis · Charlotte · San Francisco



The Dow-developed Spectrometer with simplified schematic diagram showing its essential features.

An example of Dow research

This electronic and optical device, called the Direct-reading Spectrometer, is a Dow-developed instrument which—using photoelectric tubes—measures the relative amounts of different metallic constituents in a complex alloy.

A tribute to man's intelligence and industry, the Spectrometer was devised to obtain closer control and more accurate analysis of the magnesium alloys used with such spectacular success in World War II. For the past three years it has been used in the magnesium alloying plant to make many thousands of measurements and recordings of the exact concentration of the several metals in an alloy.

An outstanding feature of the Spectrometer is its speed of operation. For instance, only thirty seconds will have elapsed from the time two magnesium samples are locked into clamps and a spark passed between them to start the operation, before an analysis can be determined from direct-reading, rotating dials.

The entire operation is automatic and takes less than 10% of the time required by the Spectrographic method of analysis, which in turn is many times faster than conventional chemical methods of analysis. This enormous saving of time enables a much closer and more nearly constant control over melting, alloying and casting of magnesium.

This method eliminates the necessity for photographic and developing equipment used in Spectrographic analysis, as well as the opportunity for photographic error possible in the latter method.

Here is another example of Dow research applied to production methods. Such research is typical of all divisions of The Dow Chemical Company . . . a company where intelligence and industry are held in high regard.

DOW

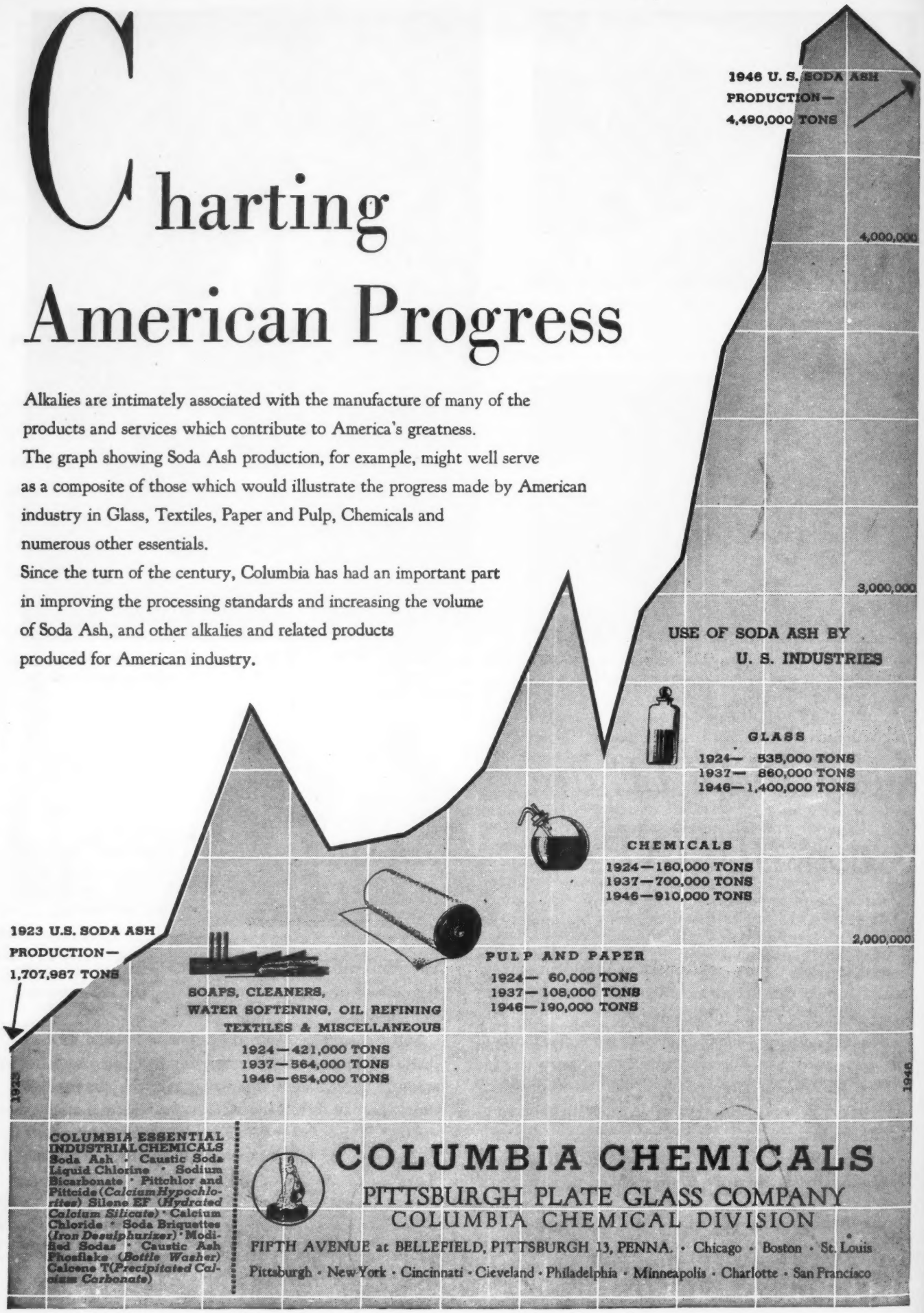
CHEMICALS INDISPENSABLE TO INDUSTRY AND AGRICULTURE

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago • St. Louis
Houston • San Francisco • Los Angeles • Seattle

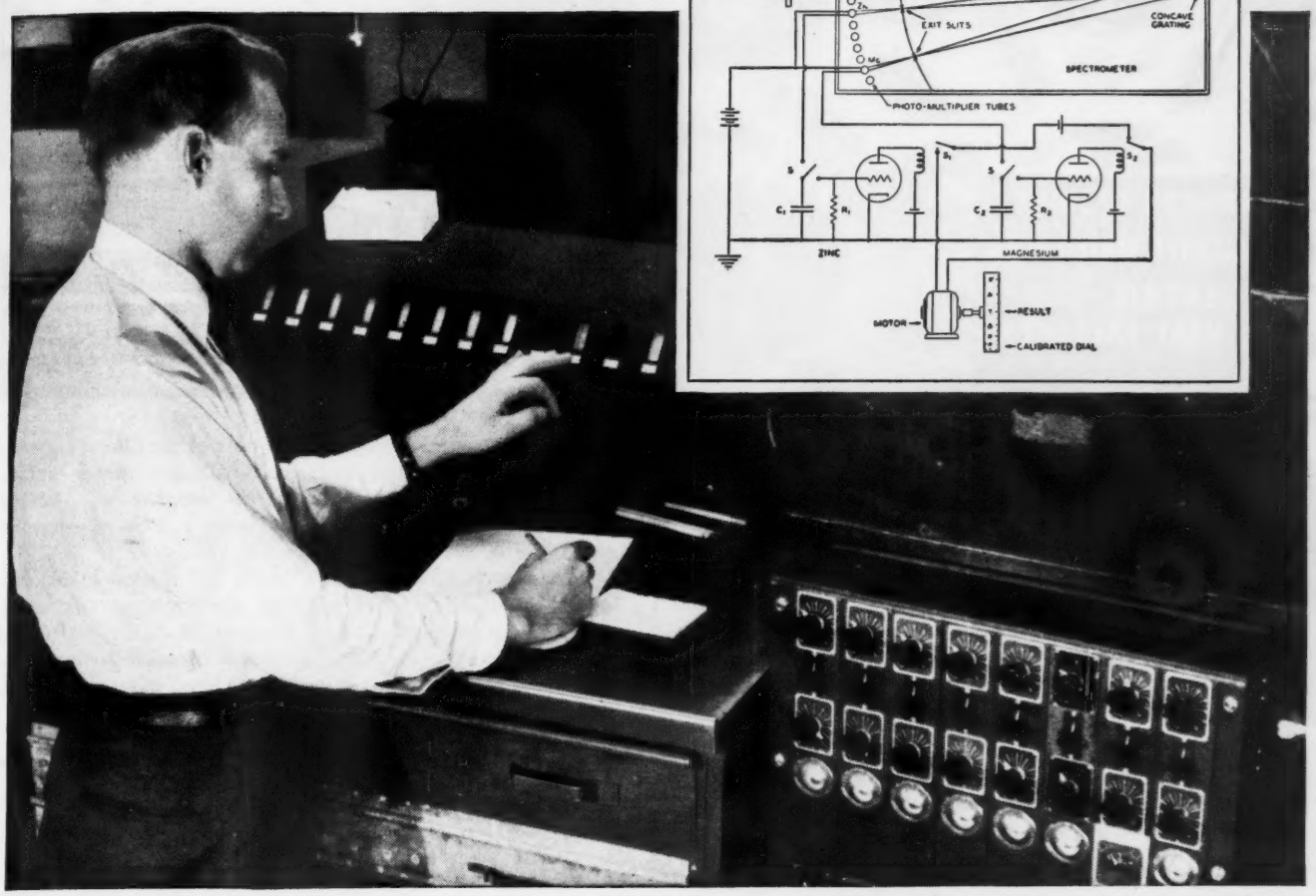
Charting American Progress

Alkalies are intimately associated with the manufacture of many of the products and services which contribute to America's greatness.
The graph showing Soda Ash production, for example, might well serve as a composite of those which would illustrate the progress made by American industry in Glass, Textiles, Paper and Pulp, Chemicals and numerous other essentials.
Since the turn of the century, Columbia has had an important part in improving the processing standards and increasing the volume of Soda Ash, and other alkalies and related products produced for American industry.



COLUMBIA ESSENTIAL INDUSTRIAL CHEMICALS
Soda Ash · Caustic Soda Liquid Chlorine · Sodium Bicarbonate · Pittchlor and Pittcide (*Calcium Hypochlorites*) Silene EF (*Hydrated Calcium Silicate*) · Calcium Chloride · Soda Briquettes (*Iron Desulphurizer*) · Modified Sodas · Caustic Ash Phosflake (*Bottle Washer*) Calcene T (*Precipitated Calcium Carbonate*)

COLUMBIA CHEMICALS
PITTSBURGH PLATE GLASS COMPANY
COLUMBIA CHEMICAL DIVISION
FIFTH AVENUE at BELLEFIELD, PITTSBURGH 13, PENNA. · Chicago · Boston · St. Louis
Pittsburgh · New York · Cincinnati · Cleveland · Philadelphia · Minneapolis · Charlotte · San Francisco



The Dow-developed Spectrometer with simplified schematic diagram showing its essential features.

An example of Dow research

This electronic and optical device, called the Direct-reading Spectrometer, is a Dow-developed instrument which—using photoelectric tubes—measures the relative amounts of different metallic constituents in a complex alloy.

A tribute to man's intelligence and industry, the Spectrometer was devised to obtain closer control and more accurate analysis of the magnesium alloys used with such spectacular success in World War II. For the past three years it has been used in the magnesium alloying plant to make many thousands of measurements and recordings of the exact concentration of the several metals in an alloy.

An outstanding feature of the Spectrometer is its speed of operation. For instance, only thirty seconds will have elapsed from the time two magnesium samples are locked into clamps and a spark passed between them to start the operation, before an analysis can be determined from direct-reading, rotating dials.

The entire operation is automatic and takes less than 10% of the time required by the Spectrographic method of analysis, which in turn is many times faster than conventional chemical methods of analysis. This enormous saving of time enables a much closer and more nearly constant control over melting, alloying and casting of magnesium.

This method eliminates the necessity for photographic and developing equipment used in Spectrographic analysis, as well as the opportunity for photographic error possible in the latter method.

Here is another example of Dow research applied to production methods. Such research is typical of all divisions of The Dow Chemical Company . . . a company where intelligence and industry are held in high regard.

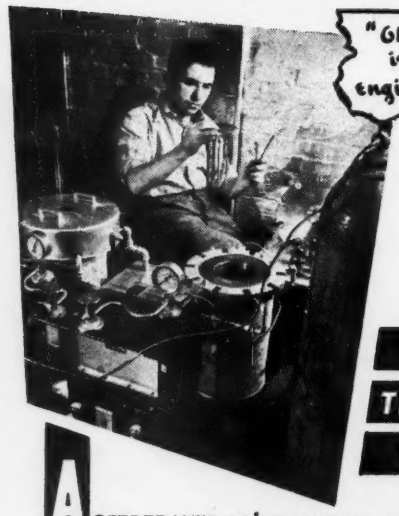
DOW

CHEMICALS INDISPENSABLE TO INDUSTRY AND AGRICULTURE

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago • St. Louis
Houston • San Francisco • Los Angeles • Seattle

BROWN & SHARPE CUTTERS



A BOMB THAT DESTROYS GUESSWORK

ACCELERATED aging tests are part of the Okonite product improvement program. While they cannot replace the study of actual exposure to weather in proving ground and in the field, they have a definite place in estimating the value of electrical insulation.

The oxygen bomb shown at the left is used in accelerated aging tests — one piece of apparatus among many other examples of modern equipment at the service of Okonite engineers and technicians in taking the guesswork out of the manufacture of insulated wires and cables. The Okonite Company, Passaic, New Jersey.

OKONITE SINCE 1878 5237

insulated wires and cables

physics at tech

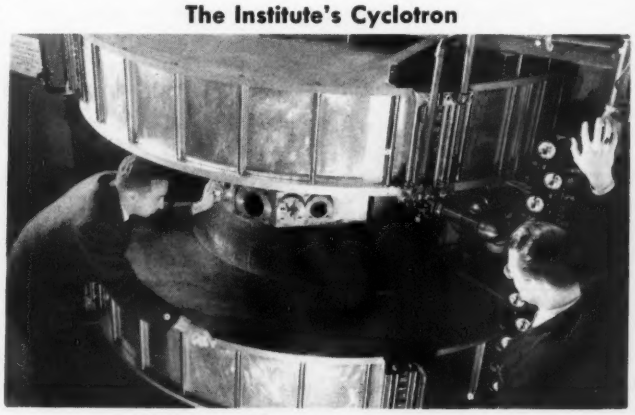
(*Continued from page 302*)

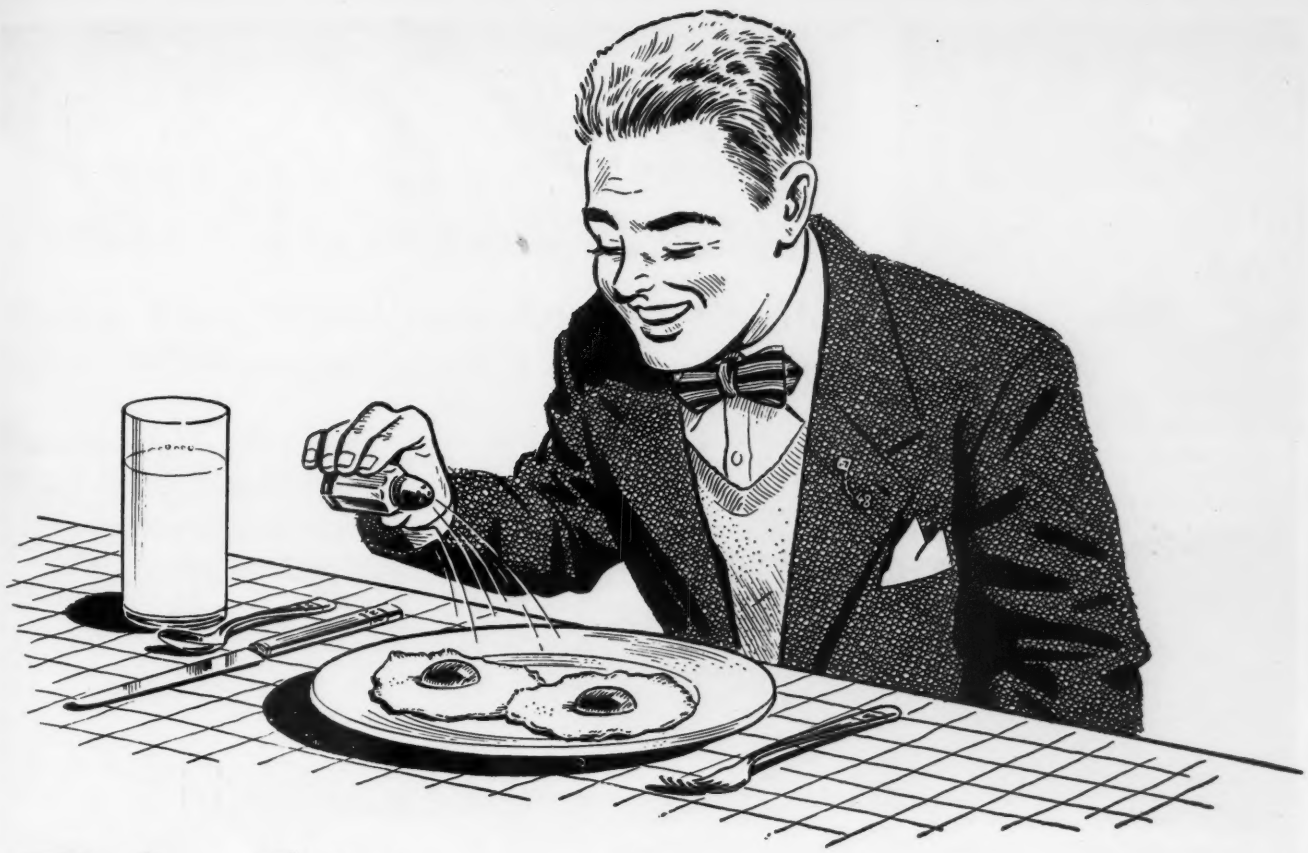
Laboratory of Electronics are two experimental fields, available to advanced students, bearing closely on thermodynamics. One is the work on microwave gas discharges, in which the type of gas excitation found in some electronic tubes is studied by microwave methods. The other is the cryogenic work, study of phenomena at extremely low temperatures. The laboratory has two cryostats, or refrigerators capable of going down to within a degree or so of the absolute zero, developed in the Mechanical Engineering Department of the Institute during the war. These low temperatures are being used for study of the electrical properties of metals at low temperature and high frequency, and for study of the extraordinary properties of liquid helium, a substance which persists as a liquid down to the absolute zero, and instead of getting more viscous or sticky at low temperatures as all other fluids do, flows more and more readily as the temperature falls.

These are some of the more interesting branches of modern physics whose study starts in the third year of Course VIII. There is also work, partly elective, in some more classical fields. The study of optics is carried farther than in the elementary work, and students have the chance of working in the advanced phases of that subject. Acoustics, the study of sound, is an elective subject which leads to more advanced work in the Acoustics Laboratory, an interdepartmental laboratory tying in with electrical engineering and architecture, as well as physics. Other interesting fields are x-rays and crystal structure, where x-ray diffraction methods lead to a study of the most detailed properties of solids; the production of large single crystals from molten materials; and the production of high magnetic fields, where the Institute has the most powerful continuous magnetic fields available anywhere.

These examples are enough to show how far beyond the classical branches of physics modern physics has developed, and to show the breadth of the interesting problems of modern physics. It also shows that the undergraduate work of Course VIII leads into all these fields and gives the student a good familiarity, both practical and theoretical, with them. All these special laboratories, among the best equipped in the world, and their expert staffs, are available for senior theses as well as for graduate students. Course VIII graduates then have a thorough familiarity with the most modern and interesting aspects of their subject.

The Institute's Cyclotron





The Miracle

you put on your eggs...

Just plain Salt! But what wonders it performs in the hands of expert chemists and engineers. Its two components play a big part in the production of paper, soap, glue, metals, metal products, textiles, insecticides. They help to sanitize water, launder clothing, kill bacteria in dairies, restaurants, food plants.

"Miracle-working" with Salt—as well as other basic chemicals—has been Pennsalt's business for 98 years. Starting with a modest plant at Natrona, Pa., Pennsalt has steadily grown, until today it stands as one of America's important chemical companies.

Big? Yes . . . but not so big as to swallow up its promising young men. Old? Yes . . . but not too old to adopt young ideas that are sound. Pennsalt was founded by a young man; and grew large through the efforts of young men.

The future, too, looks bright for Pennsalt . . . and for the young men who are going to build it. Pennsylvania Salt Manufacturing Company, Philadelphia 7, Pa.

PENN SALT

CHEMICALS

Beautiful Mississippi *shows its teeth*

No limpid stream, the Mississippi... at Venice, Illinois it is laden with angry silt. Coursing through Union Electric Company plant valves at 175 p.s.i. this abrasive action "ate up" conventional valves.

MISSISSIPPI RIVER MUD CONQUERED

Then plant engineers and Stone & Webster Engineering Corporation selected Grinnell-Saunders Diaphragm Valves. Flanged, unlined, with tough rubber diaphragm, Grinnell-Saunders Valves have far outdated previous valves and are still going strong. Grinnell Company, Inc., Providence 1, R. I.

Lick Corrosion, Contamination, Suspended Solids with Grinnell-Saunders Diaphragm Valves

- The flexible diaphragm isolates the working parts of the valve from the fluid, preventing contamination, and permits streamlined flow plus positive closure even with suspended solids.
- A selection of diaphragm materials and also body linings of glass, porcelain, lead, rubber or synthetics protects against corrosion.

PIPING SUPPLIES

• Pipe, Valves and Fittings • Engineered Pipe Hangers • Grinnell-Saunders Diaphragm Valves • Thermolier Unit Heaters • Prefabricated Piping • Plumbing and Heating Specialties • Oil, Water Works and Industrial Piping Supplies

OTHER GRINNELL PRODUCTS

Automatic Sprinklers and Special Hazard Fire Protection Systems AMCO Humidification and Cooling Systems

GRINNELL

FOUNDED 1850

WHENEVER **PIPING** IS INVOLVED

ENGINEERING GRADUATES HAVE FOUND ATTRACTIVE OPPORTUNITIES WITH GRINNELL IN PIPING ENGINEERING

DU PONT *Digest*
For Students of Science and Engineering

Many Theoretical and Applied Studies Behind Development of "Cordura" Rayon

Determination of spinning tension by C. S. McCandlish, Chemical Engineer, Northwestern University '44, and A. I. Whitten, Ph. D., Physical Chemistry, Duke University '35.

Stronger, lighter tires made possible by teamwork of Du Pont chemists, engineers, and physicists

On the surface, the viscose process for rayon seems fairly simple. Cellulose from cotton or wood is steeped in NaOH to give alkali cellulose, which is treated with CS_2 to form cellulose xanthate. Adding NaOH gives molasses-like "viscose," which is squirted through spinnerets into a coagulating bath of acid and salt to form from 500 to 1,000 filaments simultaneously:

$$\underset{\text{(cellulose)}}{R^*\text{-OH}} + NaOH \longrightarrow \underset{\text{(alkali cellulose)}}{R\text{-ONa}} + H_2O$$

$$R\text{-ONa} + CS_2 \longrightarrow \underset{\text{(cellulose xanthate)}}{R\text{-O-C(=S)-SNa}}$$

$$R\text{-O-C(=S)-SNa} + H_2SO_4 \longrightarrow \underset{\text{(cellulose)}}{R\text{-OH}} + CS_2 + NaHSO_4$$

$R^* = C_6H_7O_2(OH)_2$

Du Pont scientists were working to improve on the properties of rayon made by this process when, in 1928, a rubber company asked for a rayon yarn that would be stronger than cotton for tire cords. The problem was given to a team of organic, physical, and analytical chemists, chemical and mechanical engineers, and physicists.

Theoretical and Applied Studies

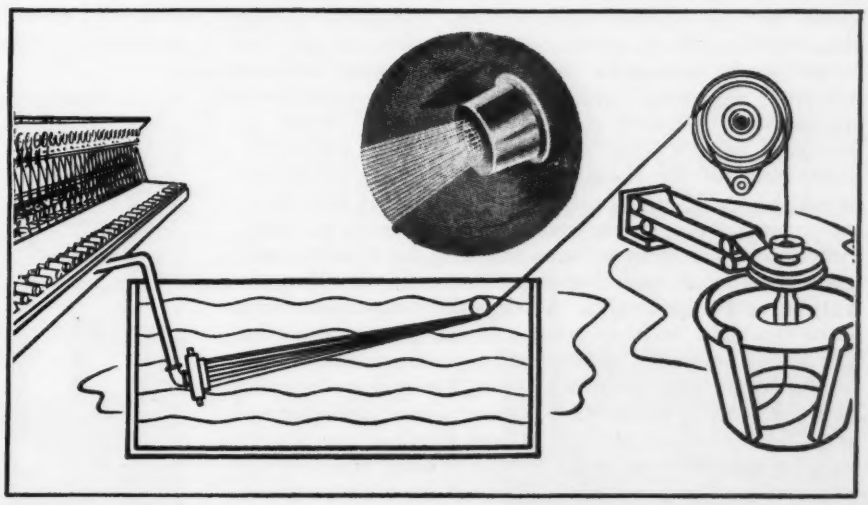
In developing the new improved rayon, a number of theoretical studies were carried out: for example, (1) rates of diffusion of the coagulating bath into the viscose filaments, (2) the mechanism of coagulation of viscose, (3) the relationship between fiber structure and properties by x-rays, and (4) a phase study of spinning baths.

Concurrently, applied research was necessary. This proceeded along many lines, but the main problem was to perfect the spinning technique. It was known that a short delay in the bath between the spinneret and the stretching operation allowed greater tension on the filaments. Du Pont engineers, therefore, designed a series of rollers, each revolving faster than the previous one, to increase the tension gradually. In addition, a textile finish was developed that combined just the right amount of plasticizing action and lubricating power, allowing the filaments to twist evenly in forming the cord. A new adhesive was prepared to join the yarn with rubber. New twisting techniques for cord manufacture were found, since the usual methods caused loss in rayon strength.

Engineering Problems Solved

Chemical and mechanical engineers were faced with the design and operation of equipment for more than 15 different types of unit operations. Equipment had to operate every minute of the day, yet turn out perfectly uniform yarn. It was necessary to filter the viscose so carefully that it would pass through spinning jet holes less than 4/1000th of an inch without plugging. Some of the most exacting temperature and humidity control applications in the chemical industry were required.

Out of this cooperation among scientists—ranging from studies of cellulose as a high polymer to design of enormous plants—came a new product, "Cordura" high-tenacity rayon, as strong as mild steel, yet able to stand up under repeated flexing. Today, this yarn is almost 100% stronger than 20 years ago. Tires made with it are less bulky and cooler running, yet give greater mileage under the most punishing operating conditions. In "Cordura," men of Du Pont have made one of their most important contributions to the automotive industry.



Rayon spinning machine. The spinning solution is pumped through a spinneret immersed in a hardening bath. Filaments are guided over a rotating glass wheel and down into the whirling collecting bucket. Inset shows close-up of spinneret; each hole forms a filament.

Questions College Men ask about working with Du Pont

How are new men engaged?

Most college men make their first contact through Personnel Division representatives who visit many campuses periodically. Those interested may ask their college authorities when Du Pont men will next conduct interviews. Write for booklet, "The Du Pont Company and the College Graduate," 2518 Nemours Building, Wilmington 98, Del.

DU PONT
REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

More facts about Du Pont— Listen to "Cavalcade of America" Monday Nights, NBC Coast to Coast

partners in creating

For 80 years, leaders of the engineering profession have made K & E products their partners in creating the technical achievements of our age. K & E instruments, drafting equipment and materials—such as the LEROY† Lettering equipment in the picture—have thus played a part in virtually every great engineering project in America.

†Reg. U.S. Pat. Off.

KEUFFEL & ESSER CO.

EST. 1867

NEW YORK • HOBOKEN, N. J.
Chicago • St. Louis • Detroit
San Francisco • Los Angeles • Montreal

solar heating

(*Continued from page 289*)

rays of the sun by a disk mounted on a hemispherical wire which is in the same latitude as the sun's travel. The recordings are constantly being taken, even when no one is at work in the office.

One of the most perplexing problems encountered in the use of chemicals for heat storage is the determination of the optimum size of container. When sodium sulfate decahydrate melts, it first forms separate layers of solid and water. As the salt starts to recrystallize, a number of different hydrates are formed, most of them not as efficient heat storage mediums as the decahydrate. It is practically impossible to get the water back uniformly into the compound without external agitation, which for numerous reasons is impractical. Therefore, some compromise must be accepted in the form of small, but more expensive, containers for the chemical. An interesting possibility would be the use of a solid foam containing the necessary compound. At the present time, there is no material which will form a foam and also be a sufficiently good conductor, and if one is discovered, it will probably be rather expensive. All organic compounds which have the right melting point and uniform composition are also eliminated by financial considerations.

In attempting this new system, Technology is trying to find the least costly combination of heat collector and storage unit. It is not yet known whether the present system should be designed for fairly long-time storage of solar heat and complete freedom from conventional heating, or overnight storage with supplementary heating for sunless days. The project now under way, as was the one before the war, is part of a general research program at Tech into the means of utilizing solar energy, undertaken as a consequence of a gift to the Institute by Godfrey Cabot in 1937. Other phases of the program include photochemical effects, such as discovering the way chlorophyll in plants converts carbon dioxide and water into carbohydrates, thermoelectric effects, and photoelectric effects. The last makes use of the fact that certain substances give off electrons when struck by light. A variation on the type of heat storage used in homes is the use of parabolic reflectors to concentrate all the radiation from a comparatively large area at one point. Oil is passed through a tube placed at the focus of the parabola and may be heated to a high temperature; all sorts of industrial possibilities are thus opened.

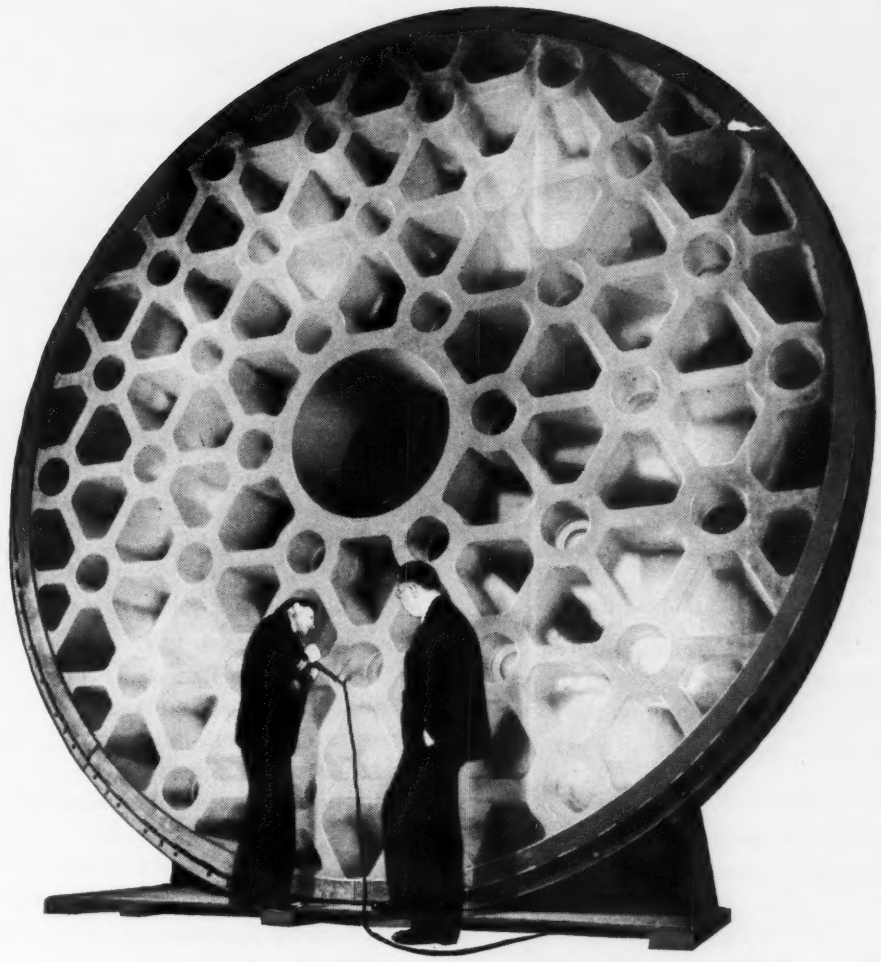
An interesting aspect of the solar heating of dwellings is the change that it will require in our design of buildings. A southern exposure in every room will be essential, producing an oblong rather than square shape. The large expanse of glass, or glass brick-like material, also makes new interior decorating and servicing procedures necessary. Solar homes will be different in other ways, too. Large overhanging eaves are essential to prevent overheating in the summer and deciduous shrubbery may also be used to provide shadows.

One of the most formidable jobs is the compiling of conclusive information for designers of solar heated homes. It is not expected that many formulas will be obtained from the data, but rather that it will be made usable in a series of charts. These will include all the various variables that a designer might encounter: latitude, size of the dwelling, thickness of the walls, price, and others.

All the data from internal and external heat changes are automatically recorded on these micromax recorders. Research Associate Czapek is shown taking a reading from one of the meters

W. B. Stahl

THE EYE THAT SEES
6,000,000,000,000,000,000,000 MILES



Tomorrow a new door to the secrets of the universe will begin to open. A door through which astronomers will be able to see 6,000,000,000,000,000,000,000 miles into space—twice as far as ever before. It is the giant telescope atop Mt. Palomar, so powerful that the canals of Mars, if there are any, will for the first time be photographed.

It all began 12 years ago when Corning cast the glass for the famous 200" telescope mirror—the world's largest piece of glass—after most experts said it couldn't be done.

For this big disc Corning scientists developed a special glass—the only practical material that would insure the permanence, stability and accuracy demanded by the telescope's designers. This glass is similar to that used for Pyrex ware and Pyrex industrial glass piping. Making the disc was a job Corning took in its stride, because it is accustomed to finding practical solutions to all kinds of glass problems. Its research laboratory has contributed to the development of more than 37,000 different items, ranging from simple custard cups to television bulbs, laboratory ware, optical glass, and Steuben artware.

If Corning has a specialty, it is the ability of its skilled engineers and craftsmen to translate research into glassware to solve modern problems. With labor and raw material costs constantly on the rise, glass may some day help you keep down the cost of your product.

Or glass may help you make your future product easier to sell. In either case, remember to write Corning Glass Works, Corning, New York.

IN PYREX WARE AND OTHER CONSUMER, TECHNICAL AND ELECTRICAL PRODUCTS ▶

CORNING
means
Research in Glass

Massachusetts Institute of Technology
CAMBRIDGE, MASSACHUSETTS

THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY
offers the following Professional Courses

SCHOOL OF ARCHITECTURE AND PLANNING

Architecture

City Planning

SCHOOL OF SCIENCE

Chemistry
Food Technology
Food Technology — Five Year Course
General Science
Geology
Mathematics
  Options: Pure and Applied Mathematics
           Industrial Statistics
Physical Biology
Physics
Quantitative Biology

SCHOOL OF ENGINEERING

Aeronautical Engineering

Building Engineering and Construction
  Options: Heavy Construction
           Light Construction

Business and Engineering Administration
  Courses: Based on Physical Sciences
           Based on Chemical Sciences

Chemical Engineering

Chemical Engineering Practice

Civil Engineering
  Group Electives:
    Sanitary Engineering
    Transportation Engineering
    Hydraulic Engineering
    General Engineering

Economics and Engineering
  Options: Human Relations
           Industrial Relations

Electrical Engineering
  Options: Electric Power
           Illumination Engineering
           Electrical Communications
           Electronic Applications

Electrical Engineering
  Co-operative Course

General Engineering

Marine Transportation

Mechanical Engineering
  Options: General Mechanical Engineering
           Engineering Science
           Automotive Engineering

Mechanical Engineering-
  Co-operative Course

Metallurgy
  Options: Metallurgy
           Mineral Dressing

Meteorology

Naval Architecture
  and Marine Engineering

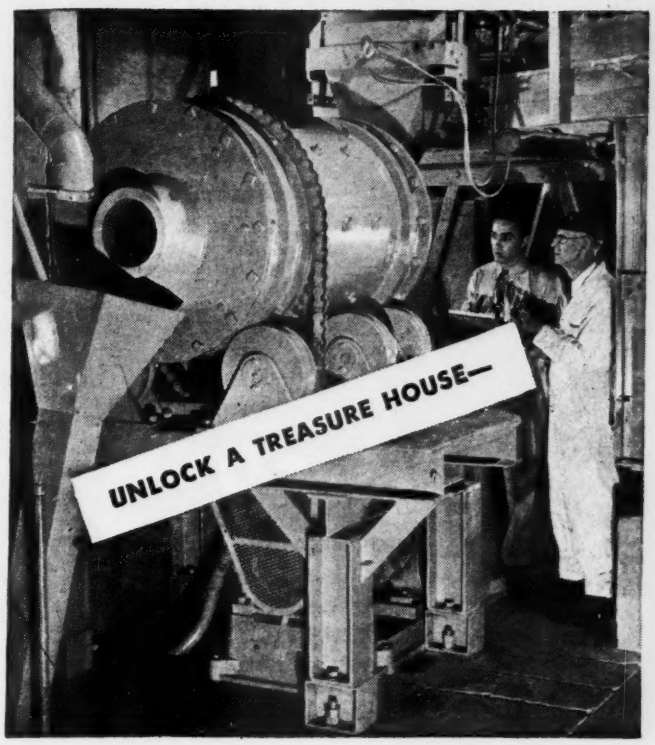
The duration of each of the above undergraduate Courses is four academic years, with the exception of Architecture, Food Technology (Five Year Course), Physical Biology, and the Co-operative Courses in Electrical Engineering and in Mechanical Engineering, which extend over a period of five years. In addition to the Bachelor's degree, the above five year courses, with the exception of Architecture, lead also to the Master's degree.

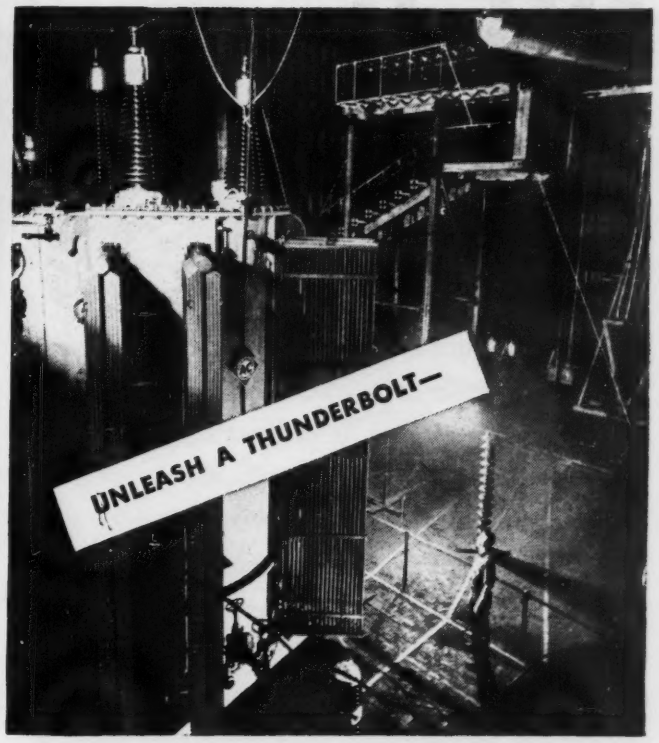
Graduate study, leading to the Master's and Doctor's degrees, is offered in Ceramics and in most of the above professional Courses.

A five year Course is offered which combines study in Engineering or Science, and Economics. This leads to the degree of Bachelor of Science in the professional field, and to the degree of Master of Science in Economics and Engineering or Economics and Natural Science.

For information about admission, communicate with the Director of Admissions.
The Catalogue for the academic year will be sent free on request.

OPEN: New Fields to Explore!





AN Allis-Chalmers scientist seeks new, better ways to reduce low-grade ores . . .

. . . another hurls lightning at giant transformers to test abnormal stresses . . .

. . . another catches "wolf whistles" from the sun for clues to better power transmission!

The whole history of A-C is one of far-flung research and pioneering . . . of revolutionary advancements in almost every field of science and industry!

Whatever your chosen field—electric power, hydraulics, processing, machine design or production—you'll find unequaled opportunities in Allis-Chalmers' broad range of operation!

INVESTIGATE

ALLIS-CHALMERS

ONE OF THE BIG 3 IN ELECTRIC POWER EQUIPMENT—
BIGGEST OF ALL IN RANGE OF INDUSTRIAL PRODUCTS!

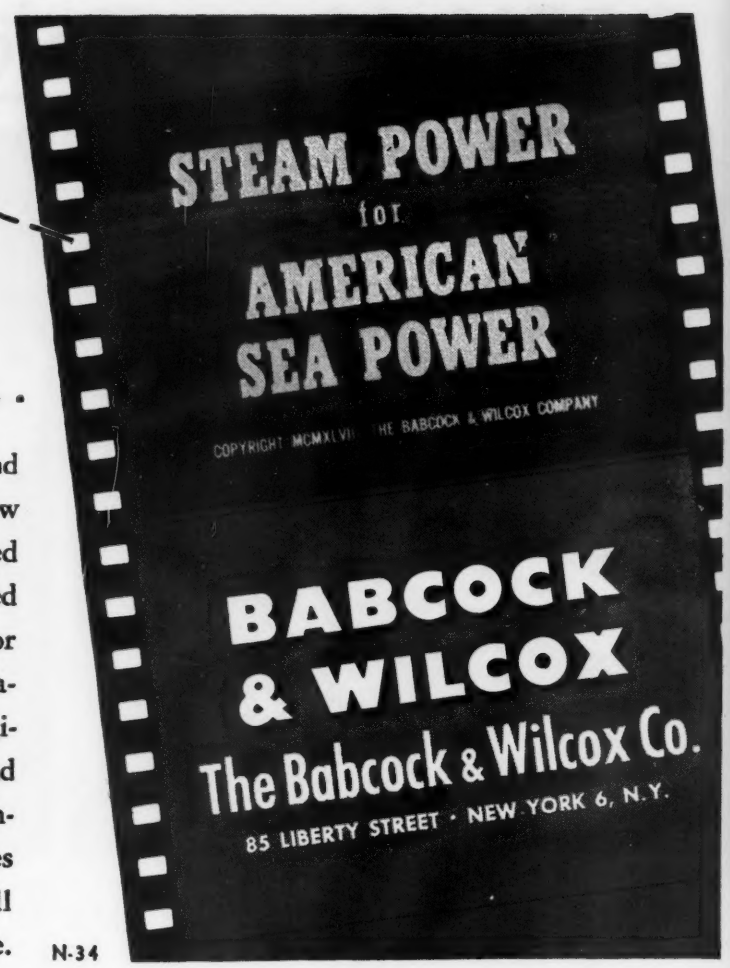
Write for Book No. 6085, outlining A-C's Graduate Training Course.

Allis-Chalmers Mfg. Co., Milwaukee 1, Wisconsin

SEE...

New interesting story of . . .

How boilers are built for modern naval and merchant vessels—how they are installed—how they function—all this is interestingly narrated and vividly pictured in a recently-completed 16mm sound film entitled "Steam Power for American Sea Power". It is a 30-minute educational movie that students in any phase of engineering will find thoroughly enjoyable and enlightening. B&W will gladly loan a print without charge for showing to engineering classes and student groups. Simply drop a line for full particulars to B&W at the address given here.



N-34

of and for the students

(*Continued from page 293*)

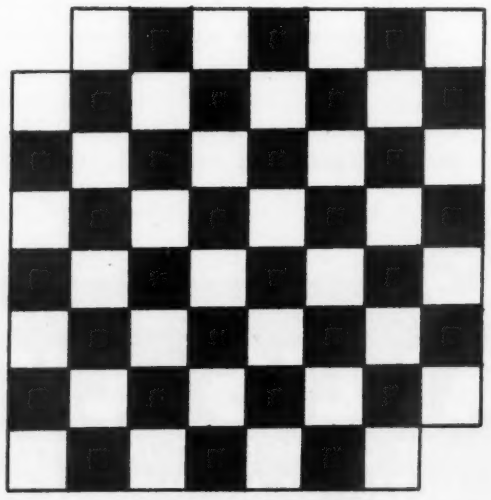
assures them of fair treatment and firm backing of both a financial and morale nature.

In contrast to the undergraduate organizations found at some other institutions, one of the salient principles upon which the M. I. T. student government runs states that no organization shall be run for the profit of any individual or group of individuals, with the possible exception of the Senior Week Committee, the organization planning the seniors' last big celebration before graduation, whose members are financially responsible for any profit or loss shown by the week of events in their care. It is also interesting to note that, speaking in general, no activity on the Tech campus has long remained under the domination of any particular group and that the see-sawing of factions only too often found elsewhere on campus and off is present only to a small degree, with the government being conducted carefully in the best interests of the student body as a whole. As a part of this self-governing system, the Tech student — often maligned as a hopeless grind and slide-rule jockey — has a fine opportunity to develop facets of his education which would otherwise be sadly neglected. As a symbol of the undergraduate on campus and his representative in the outside world, the M.I.T. Undergraduate Association stands as evidence that the American college student can successfully govern himself on an independent basis with a minimum of fanfare.

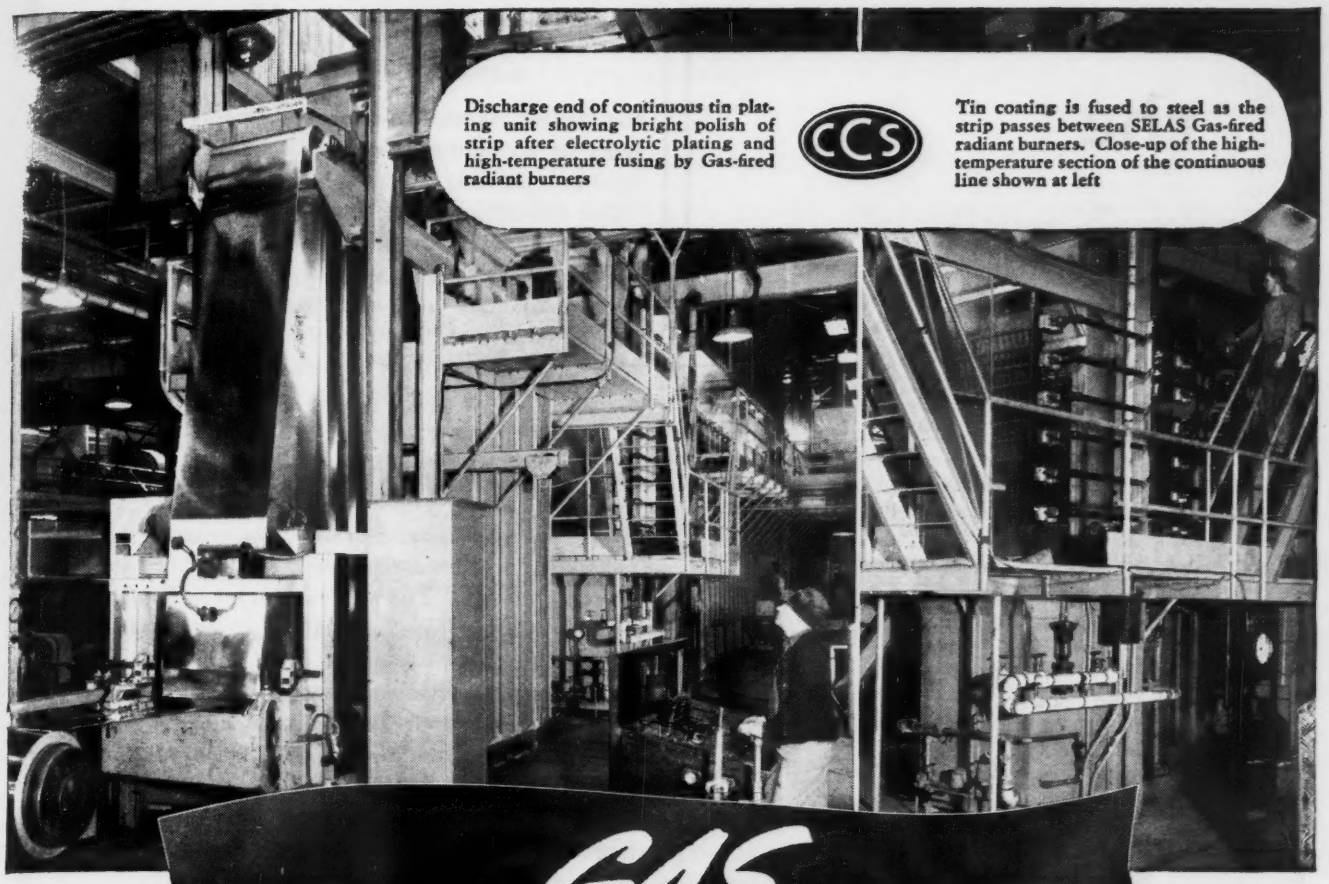
can you do it?

Problem

Given an ordinary checkerboard with two opposite corner squares cut off, as shown in the accompanying figure. Is it possible to cover the checkerboard completely, using rectangles two squares long and one square wide? (Either show how it can be done or prove that a solution is impossible.)



(*Solution on page 316*)



Discharge end of continuous tin plating unit showing bright polish of strip after electrolytic plating and high-temperature fusing by Gas-fired radiant burners

CCS

Tin coating is fused to steel as the strip passes between SELAS Gas-fired radiant burners. Close-up of the high-temperature section of the continuous line shown at left

RADIANT GAS BURNERS create high-temperature tin-coat fusing zone

BRIGHT FINISHING was the problem—and engineers of Crown Cork and Seal Company, Inc., Baltimore, adopted a high-temperature method for fusing tin to low-carbon strip, with resultant high-polish surface, in a continuous production mill.

Then, to obtain the high temperatures necessary for heat-processing, these engineers selected GAS and modern Gas Equipment. By directing the heat of radiant GAS burners over a concentrated area of the freshly-plated strip it was readily possible to coordinate the fusing action with the plating process to accomplish continuous high-speed production of bright finished strip.

This typical installation demonstrates the flexibility of GAS and the applicability of modern Gas Equipment for continuous, production-line heat processing. Compared with available fuels GAS is most readily controlled by simple automatic devices; Gas Equipment can be adapted for use with existing machinery or incorporated in new machinery without radical design changes, or expensive supplemental apparatus.

Manufacturers of Gas Equipment and the American Gas Association support continuing programs of research designed to assure the most efficient use of GAS for every heat-processing requirement.

AMERICAN GAS ASSOCIATION
420 LEXINGTON AVENUE, NEW YORK 17, N. Y.

MORE AND MORE...
THE TREND IS TO GAS
FOR ALL INDUSTRIAL HEATING

the
new
tech engineering news

is written for
the student

not
the professors

not
the brownbagger

but—
THE STUDENT

t. e. n.

june, 1948 . . . november through june, 1949

briefing the news

(*Continued from inside back cover*)

the impact, as much of this lost energy as is possible must be transformed into light, and as much of this light as is possible must reach the photo-multiplier tube. Other difficulties arise, however, because of thermionic electron emission in the photo-multiplier tube in the absence of light and because of background radiation from radioactive contamination. Thermionic emission can be largely eliminated by cooling the photo-multiplier tube; background disturbance can be lessened by manipulation of grid voltages in the amplifier.

Perfected Walkie-Talkie . . .

A new walkie-talkie radio has recently been perfected. It will be inexpensive, costing between thirty and forty dollars. The whole outfit is small enough to be carried in a coat pocket and weighs only two or three pounds.

The range of this radio will vary from one or two miles in the city to five or ten miles in rural areas. It is to be a two-way sending and receiving system operating between 460 and 470 megacycles. A screwdriver may be used to tune the set to any one of several waves within this band. The radios will be factory pretuned to one particular wave if they are to be always used by the same two people. It is expected that operating licenses for these radios will be easily obtainable.

---

can you do it?

Solution

Each rectangle two squares long and one square wide contains one black square and one white square. Therefore, if it were possible to cover the checkerboard using these rectangles, we would have to cover just as many white squares as black. But the two corner squares which have been cut off are necessarily both of the same color (black, in our diagram). Therefore there are more white squares than black on the board and the required construction is impossible.

briefing the news

Acoustical Heaviside-Layer . . .

"Leaping sound" is the latest phenomenon to be reported by the Naval Ordnance Laboratory.

A group of physicists headed by Dr. J. V. Atanasoff manned a string of ten observation posts spaced across Europe from Cuxhaven, Germany to Gorizia, just outside of Trieste, when the British destroyed Heligoland in the North Sea with five thousand tons of high explosives last year. Their mission was to measure the intensity and to determine the precise arrival times of the "inaudible" sound waves set up in the atmosphere by the world's greatest man-made explosion. The quick-burning fuses were so arranged that the detonations would be simultaneous.

The sound waves generated by the blast quickly became too attenuated to be detected by the human ear, but extremely acute sound-sensitive mechanisms were capable of picking up some of the atmospheric reverberations at distances of six hundred miles. The first analysis of the observers' reports shows that the times of arrival were hours late for some stations yet almost exactly punctual for posts further along the chain. The task of analyzing the reported data, now being conducted in Washington, D. C., is enormous and will not be completed for some time.

A phenomenon similar to this is known in electrical work in the instance of radio waves being reflected off the so-called "Heaviside-layer," one of the electrical roofs of the world, thus making long-distance transmission possible. Dr. Atanasoff is of the opinion that this new situation might in turn be caused by a "sort of acoustical Heaviside-layer."

The speed of sound varies with temperature, and recent V-2 flights have demonstrated that above the stratosphere there is a rapid increase in temperature, then a sharp decline to far below 0, and, finally, tropical heat. This difference in temperature could very well have the same effect on sound waves as electrical strata have on radio waves. According to Dr. Atanasoff, calculations based on V-2 findings agree very closely with the results of the Heligoland blast. If this should really be the case, it might be feasible to measure the temperatures of the upper atmosphere by sound waves.

Scintillation Counter . . .

A new instrument for the measurement of radiation intensity, the scintillation counter, has been developed by Professor Hartmut Kallman of the Kaiser Wilhelm Institute for Physical Chemistry in Berlin and by Professor Martin Deutsch of the Massachusetts Institute of Technology. Its operation is based on the principle that sub-atomic particles produce minute light flashes, or scintillations, when they come in contact with fluorescent materials. By counting the number of these flashes and their intensity, the number of particles and their energy can be measured. The advantage of the scintillation counter over other instruments such as the Geiger counter and the ionization chamber is that, whereas the latter instruments are practical only for the counting of highly ionized particles (*i.e.*, mainly alpha particles and protons of moderate energy), the scintillator may be used to detect electrons and gamma ray quanta as well as heavily charged particles. An idea of the sensitivity of this new device may be gained from the testimony of Dr. James S. Allen of the Institute for Nuclear Studies, according to whom responses have been obtained with the scintillation counter in less than one-tenth of a micro-second in tests conducted at the University of Chicago.

Fundamentally, the construction of the scintillator is quite simple. It consists of a photo-multiplier tube surrounded by fluorescent material. The tube is connected to an amplifier which is in turn connected to an oscilloscope or a thyratron counting circuit. Whenever a charged particle strikes the fluorescent material, the resultant light flash excites the photo-multiplier tube and the signal from the tube is amplified and then interpreted on either the oscilloscope or the thyratron circuit. If the oscilloscope is used, the number of particles incident upon the fluorescent material can be measured from the number of pulses on the oscilloscope screen. The size of the pulses, on the other hand, indicate the energy released by the particles in their respective collisions. If the counting circuit is used, only the number of incident particles is recorded.

Basically, the successful operation of the scintillator is dependent upon three factors: as great a part of the energy of the particle as is possible must be lost in

(*Continued on page 316*)

Careers at GENERAL ELECTRIC

'PILE' ENGINEER . . . ACCOUNTANT . . . SILICONES SPECIALIST

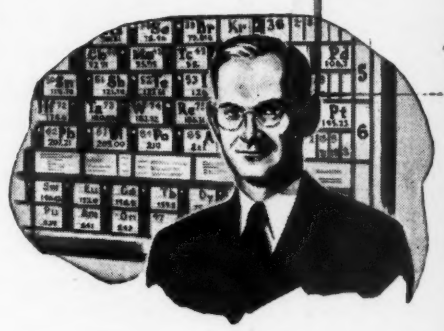
for each, General Electric has assignments to his liking

General Electric is not one business, but an organization of many businesses, ranging from the building of transformers at Pittsfield, Mass., to the molding of plastics at Anaheim, Calif. Graduates of American colleges and universities are finding that the 125 plants of General Electric offer opportunities to all degrees of specialists, all sorts of enthusiasms, all kinds of careers.

CORNELL UNIVERSITY
MAY 1 5

'PILE' ENGINEER

Quoting Dr. W. I. Patnode (Cornell '27) of the G-E Nucleonics Project: "Seldom has the engineer been offered the opportunity to achieve greatness that is contained in the development of atomic power . . . The pile engineer must know radiation as the aeronautical engineer knows air flow, as the electrical engineer knows electromagnetism . . . There is work for more pile engineers, educated men who comprehend the nature and magnitude of controlled nuclear energy."

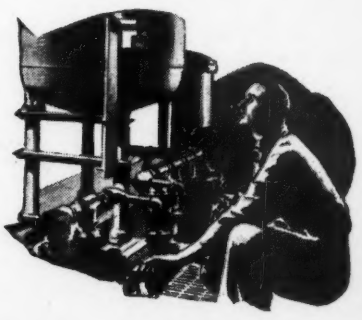


UP FROM BTC

Donald L. Millham (Union '27), today the G-E Comptroller, is one of the many top officials of General Electric who got their start in the company's Business Training Course, the oldest nontechnical training program offered by industry. BTC trains nontechnical college graduates for managerial accounting positions such as department comptrollers, division accountants, district auditors, operating managers, and treasurers of affiliated companies.

SILICONES SPECIALIST

"The field of silicon chemistry has only been touched, with new developments continually appearing"—that is the opinion of Jerry Coe (M.I.T. '42), now helping start up the new G-E silicones plant at Waterford, N. Y. Oils, resins, greases, "bouncing putty," and rubber having silicon as a basis of the molecule are now being marketed in increasing quantities, as they gain recognition for their striking temperature stability and other unusual properties.



FOR YOUR COPY OF "CAREERS IN THE ELECTRICAL INDUSTRY," WRITE TO DEPT. 237-6, GENERAL ELECTRIC CO., SCHENECTADY, N. Y.

GENERAL ELECTRIC